PUBLIC WORKS

Oct. 1959

CITY, COUNTY AND STATE

EROSION CONTROL DAMS Replace County Highway Bridges page 95

Electronic Control Center for Milwaukee's WATER WORKS page 104

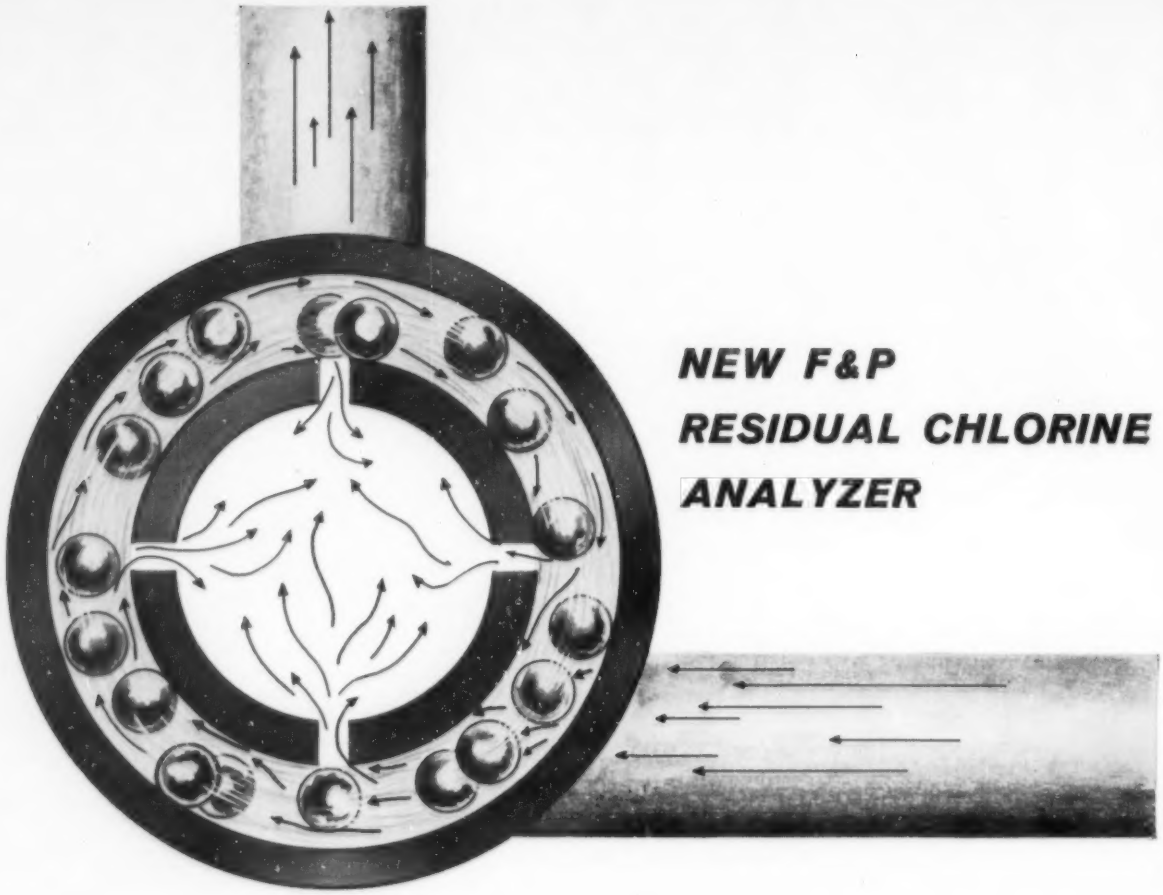
Power and Heating from SLUDGE GAS page 110

How to Compute Pressure Loss in AIR PIPING page 129

New Incinerator Provides Unique FLY-ASH CONTROL page 135

AND MANY OTHER IMPORTANT ARTICLES SEE PAGE 5

Walter M. Franklin is General Superintendent of the Charlotte, N. C., Water Department and also of the City sewage and industrial waste treatment works, with responsibility for all operations. See page 18.



NEW F&P RESIDUAL CHLORINE ANALYZER

stays accurate with *Micro-Ball*® self-cleaning action

Continuous accuracy . . . *continuous* sampling of chlorine residual . . . you get both with F&P Depolox* Amperometric Analyzer. Electrodes are kept electrically stable by F&P's exclusive Micro-Ball self-cleaning cell design. The resulting long-term dependability is a matter of record in hundreds of applications.

Micro-Ball self-cleaning is as simple as it is dependable. A number of tiny glass balls are continuously circulated between the concentric electrodes of the sampling cell. Polishing action of the whirling Micro-Balls keeps the electrodes clean . . . assures long electrode life and continuous accuracy. The Micro-Balls are retained permanently in the sampling cell. No abrasive grit is ever necessary. And there's never any danger of clogging. All these features make Depolox ideal for completely automatic closed-loop chlorination systems.

Get all the facts you need on Depolox Residual Chlorine Analyzer by contacting the F&P field engineer nearest you, or write Fischer & Porter Company, 609 Fischer Rd., Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Downsview, Ontario.

**Licensed by CHLORATOR . . . Pat. Pending*

FP FISCHER & PORTER COMPANY INSTRUMENTATION AND CHLORINATION

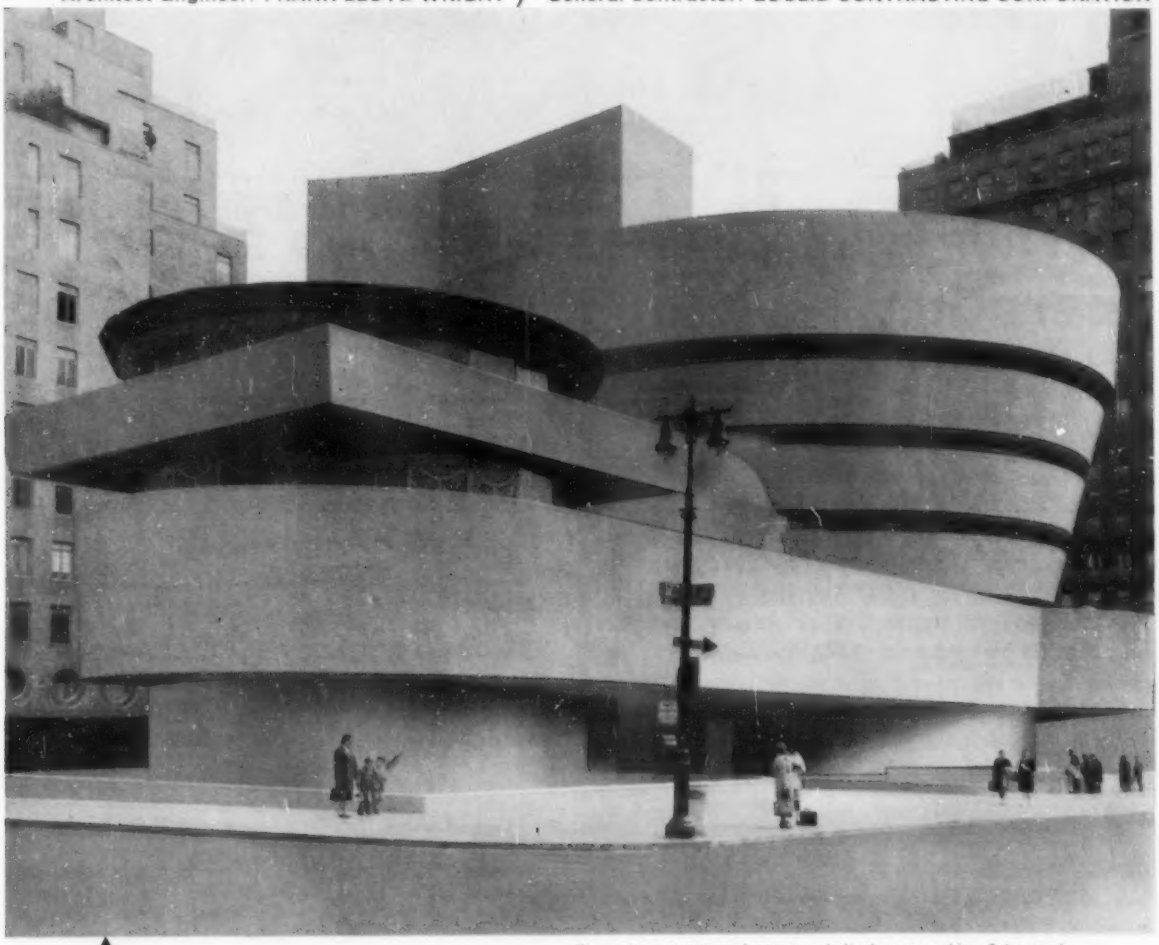
Improved consolidation with PLASTIMENT

The new Guggenheim Museum . . . Frank Lloyd Wright's daring architectural achievement on New York's Fifth Avenue . . . testifies to the ability of Plastiment to provide sound, well-consolidated concrete under conditions of involved forming and complex reinforcing . . . Selected by the contractor, Plastiment Retarding Densifier was used to minimize cracking, to assure more uniform quality, and to provide architecturally pleasing exposed concrete over large areas . . . Plastiment gave the desired workability at 3 to 4 inch slumps, resulting in a minimum of surface defects when forms were stripped.

Call Sika direct or contact your nearest Sika distributor for catalog, technical information and service.

Dealers in principal cities, affiliates around the world.

Architect-Engineer: FRANK LLOYD WRIGHT / General Contractor: EUCLID CONTRACTING CORPORATION



The unique structure features a helical ramp making 6 turns at grades of 3% and stiffened by exterior webs at 30° intervals.

Sika®

SIKA CHEMICAL CORPORATION

Passaic, N. J.

City of Hampton, Virginia, has a population of 80,000 and covers an area of 60 square miles. This No. 112, one of three machines used to maintain 350 miles of road, delivers outstanding performance.

This No. 112 does a big job at low operating cost for the City of Hampton

You're looking at a Cat No. 112 Motor Grader working shoulders on a typical street in the City of Hampton, Virginia. The No. 112 averages 5 miles per 7-hour day on this job. The city keeps it busy all year round rebuilding roads, spreading rock and lime, cleaning ditches and removing snow. Officials in the Public Works Department responsible for its purchase say this about its performance: "The No. 112 does a big job for us at low operating cost. Our maintenance worries are nonexistent. We are very satisfied with it and with the speed and reliability of service from our Caterpillar Dealer."

When you invest your taxpayers' dollars in a machine, performance and dealer service are two important factors to consider. Even more important is this factor—*total* cost. Public records from all over the country prove that the *low* total cost of Cat Motor Graders makes them your best investment. Accurate cost records of yearly operation and maintenance give evidence of the job you can expect from a Cat-built machine.

To match your job needs, your Caterpillar Dealer offers two other Motor Graders besides the 75 HP, 20,805 lb. No. 112. There's the 115 HP, 23,115 lb. No. 12 and the new 150 HP, 29,280 lb. No. 14. Each is designed to do more work at lower cost with less down time than any other grader in its class. Ask to see them work!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

PRECO AUTOMATIC BLADE CONTROL CUTS GRADING TIME IN HALF

—optional on the Cat No. 112 Motor Grader

Exclusive with Caterpillar, the Preco Control is now transistorized for freedom of maintenance and adjustment. The operator sets the desired slope on a dial, and the unit automatically maintains blade slope within ⅛" in 10', regardless of position of grader or unevenness of terrain. Fine for *all* types of grading. Preco is also optional on the No. 12 and No. 14.

Mechanical controls (standard) offer positive action, make blade adjustment precise. Powered right from the engine, they give a speed and range of blade movements that no other unit can match.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

BUY LOW TOTAL COST—
BUY CAT MOTOR GRADERS

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

OCTOBER, 1959 • Volume 90, Number 10

Erosion Control Dams Replace Old Wooden Bridges .. 95
How counties in Iowa are working with Soil Conservation Districts to check soil loss and improve highway crossings over deep gullies. C. A. ELSEA

The Effect of Interchange Spacing 98
A discussion of the factors affecting interchange design and spacing. STEFAN SALEK

Service Proves Value of Automatic Time Recorder 101
Why over 1000 are used on construction equipment of the Minnesota Highway Department. VINCE BOVITZ

Put it on Microfilm 102
The Cook County (Ill.) Highway Department finds that microfilmed plans promote availability of data, reduce storage and provide safety. F. A. CERWIN

Control Center for Milwaukee's Water Works 104
New system of data logging centralizes the information needed for control of an extensive water system. ARTHUR RYNDERS

Electronic Information System Provides Centralized Records and Operational Control 105
Details of the data logging system installed in Milwaukee, and how it works. ALAN L. VINK

Sludge Gas Utilization 110
A comprehensive review of factors in sludge gas production, design of gas control systems and the many types of equipment available for the utilization of sludge gas. WADE G. BROWN

Sweeping City Streets 118
Results of a survey on street sweeping practices.

Snow and Ice Control on County Highways 121
Organization and equipment needed to cope with winter storms on county highways. L. F. WAGNER

Radiation Monitor for City Water Supply Systems 122

Westchester County Spearheads Trend Toward New Directional Signs 123
Larger signs, reflectorized for night visibility, reduce driver confusion. ARTHUR FREED

Roadbuilding Through Hills of Clay 124
Problems associated with highway construction on unstable soils. C. B. LAIRD

Pressure Loss in Air Mains Due to Friction 126
Basic data for the design of aeration systems for activated sludge plants, including graphs for the solution of complex formulas. R. S. RANKIN

The Effect of Adding Water to Municipal Refuse for Increased Compaction in Sanitary Landfills 129
A report on a study by the USPHS. EDWARD R. WILLIAMS, GEORGE F. MALLISON AND PAUL F. MAIER

A Field Study of Contact Aeration 130
A review of plant design and specific plant studies. ERNEST W. STEEL

City Prefabricates Housing for New Well 132
ANDREW J. BROWNING

Cleaning Guard Rails 133
Washing operations restore reflective qualities to 5.7 miles of median divider. R. A. SCOTT

Stump Removal on a Large Scale 134
Mechanized clean-up follows Dutch elm blight.

New Incinerator Gives Complete Fly-Ash Control 135
How unique design minimizes air pollution.

Sewer Rental Program in Pennsylvania 152

Using Soil Cement for Reservoir Linings 154

We HAD a Sewer Problem! 208
How an increasing cleaning load was overcome by modern equipment. JAMES W. DAY

Traffic Engineering in Tomorrow's Transportation 216
A discussion of the challenges and opportunities facing traffic engineers. D. GRANT MICKLE

Repaver Irons Out Road Wrinkles 216

PUBLIC WORKS DIGESTS:

Water Works 144
Highways and Airports 160
Sewerage and Refuse 176
Industrial Wastes 192

EDITORIAL DEPARTMENT

W. A. Hardenbergh, *Editor*
A. Prescott Folwell, *Editor Emeritus*
Edward B. Rodie, *Managing Editor*
Clayton H. Billings, Frank Force, Helen E. Quinn, *Associate Editors*
D. A. Okun, *Technical Consultant*
Nathaniel Pousette-Dart, *Art Consultant*

DEPARTMENTS AND SECTIONS:

The Editor's Page 7
Leader in Public Works .. 18
Books in Brief 20
Reviews of Catalogs 32
Letters to Editor 64
Legal Notes 72
APWA News Bulletins 137
Commentary on Water and Sewage Treatment 82
Municipal Power 204
Equipment News 225
News of Engineers 231
Worth Seeing 233
Worth Telling 234

READERSHIP Eastman RESEARCH

Established 1896
Public Works T. M. Reg. U.S. Pat. Off.

Published Monthly by Public Works Journal Corporation. Office of Publication at Orange, Conn. Editorial and Advertising offices at 200 So. Broad St., Ridgewood, New Jersey. Subscription rates: U.S.A. and possessions, $5.00. Canada and South America, $6.00. All other countries, $7.00. Accepted as controlled circulation publication at Orange, Conn.

EPA

Copyright 1959 by
PUBLIC WORKS JOURNAL CORP.
200 So. Broad St., Ridgewood, N. J.

ZF PREFABRICATED PUMPING STATIONS

THIS IS THE STATION THAT IS PREFABRICATED

AND DELIVERED TO JOB SITE

READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

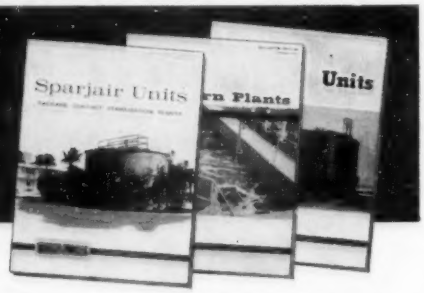
COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZF ZIMMER & FRANCESCON P.O. BOX 359, MOLINE, ILLINOIS

WALKER PROCESS PACKAGE PLANTS

UNIT DESIGNS FOR SMALL SEWAGE TREATMENT PLANTS

SIMPLE OPERATION — 90% automatic
ODOR FREE — no septic or stale operations
ADAPTABLE — concrete or steel tank construction



Details and preliminary plans are available to Consulting Engineers and their Architects, concerned with the design of small communities, subdivisions, institutions, schools, etc.

SPARJAIR Unit installed at a large Florida motel to handle 25,000 gpd combined sanitary and restaurant wastes. Note proximity of plant to motor court. Odor-free operation eliminates need of isolating plant.

SPARJAIR UNIT — Nested Contact Stabilization Plant — an easy to operate, low cost, small sewage treatment plant that is a model of simplicity. Designed on a new but proven principle, the contact stabilization process aerates and thoroughly oxidizes all odors in the sewage and overcomes previous objections to locating a plant near residences, shopping areas, schools, etc. Raw sewage settling tanks and septic digesters are eliminated. This plant utilizes a separate chamber for complete aerobic digestion (42% volatile remaining) of excess sludge.

Simple operation with minimum moving parts requires only part time attention. Capacities from 50 to 5000 population equivalent.

AEROBURN PLANTS — Package Aerobic Digestion; 24-hr. "Wet Burn" Aeration—designed for installations where economy is a prime factor and clarity of plant effluent is not vital. As with SPARJAIR units, the operation is odor free and practically automatic; with no delicate biological balances to achieve and hold.

Four standard sizes at 50, 100, 150 and 200 population equivalent.

SPARJPAC — Package Trickling Filter Plants — combines trickling filter and "wet burning" digestion in a two-story, compact design to provide best features of each type of treatment. SPARJPAC plants utilize DOWPAC® trickling filter media, developed by The Dow Chemical Company.

Design capacities range from 50 to 2500 population equivalent.

(DOWPAC is a registered trademark of The Dow Chemical Company).

WALKER PROCESS EQUIPMENT INC. factory • laboratories engineering offices **AURORA, ILLINOIS**

POINT OF VIEW

Trends in Sewage Treatment Plant Construction

ACCORDING to an excellent study by the Public Health Service, there were 1440 sewage treatment works contracted for during 1958. Of these, 507 were for communities of less than 2500 population— 116 of them for places with less than 500 population. In the population range of 2500 to 10,000, 346 works were contracted for. There were 84 works of unknown size reported.

This gratifying growth in sewage treatment for small communities is due largely to the Public Health Service program for grants to aid in construction. This has helped greatly and it should be extended and continued; and the states, also, should add their shares to help these small communities which find it perhaps impossible to carry the burden unaided.

It is of interest to note that 1958 contract awards for sewage treatment works totalled more than $388 million. Of this $128 million was for new plants; the remainder was for additions, enlargements, alterations, outfalls, interceptors and joint projects. Not generally included are works treating industrial wastes. The total of $388 million compares with $351 million in 1957.

It will take many years to catch up with our needs in waste treatment, but it is good to know that some progress is being made.

The St. Lawrence Seaway and Our Lake Port Cities

HOW PROFOUND an effect the St. Lawrence Seaway will have on our Lake cities no one can now fully foretell. It is safe to assume, however, that every city must improve its port facilities or fall behind its neighbors who do provide for bigger ships and better facilities for them. Yet the job is not solely one of deeper harbors and better piers.

With more freight to be handled, a better street system, integrated with through highways, will be needed. Truckers cannot afford delays due to traffic jams on outmoded narrow streets. It costs money to operate big trucks and they pay off only when they are moving. In many cases new and larger water facilities must be provided at the waterfront, both for fire protection and for watering ships. Water mains at the piersides mean potential pollution unless back-flow preventers are installed. Improvements must be made in drainage and in sewerage to prevent harbor pollution. Likewise, provision must be made for refuse collection and disposal to prevent unsightly contamination of the harbor by floating waste.

These are by no means all of the problems that will have to be solved; others will arise. Now is the time to think about them and to begin planning.

The Authority—Is it An Unmixed Blessing?

THE DEVELOPMENT of authorities to solve municipal, state and interstate problems is comparatively recent—within the past generation or so. Helpful as they have been in many cases where existing governmental agencies were unable to function, they are not a totally unmixed blessing. Too many of them develop a monolithic trend. Often not answerable to anyone, it is possible to cover up deficiencies and lack of progress. In some cases, operating information is not issued; visitors are not welcome, or are shown only what it is desired they see. Often authorities are restricted by the terms of their bond indentures, requiring strict management. When to this is added the natural tendency to avoid any criticism, the trend toward secrecy may become strong. We are for authorities because they have a useful place in the public works field; but we think that a review of their powers and of the existing policies in regard to their formation ought to be reviewed.

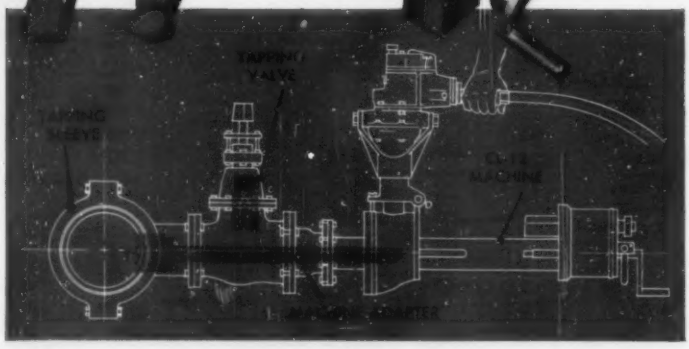
The Increasing Problem of Highway Maintenance

THE DAY AFTER construction ends maintenance begins. This applies to every structure but it is especially pertinent to highways. The heavy traffic loads on the surfacing and the wide areas along the roadsides require prompt and skilled maintenance. Safety requires the fewest possible men exposed to traffic hazards; and economy requires the maximum use of modern equipment.

Much equipment has been developed which is of value in maintenance as well as construction; specialized maintenance equipment has also been developed. But we do not think enough stress has been laid on the undoubted values that such equipment can contribute. There is more glamor in construction than in maintenance, but construction comes only once in a generation while maintenance is required day after day through the years. The men who keep our highways in shape are entitled to the best in modern equipment.

connect branch mains

FAST!



MUELLER®
Tapping Sleeves and Valves

MUELLER
CL-12 Drilling Machine

Just follow these few simple steps:

1. Attach tapping sleeve to main.
2. Bolt tapping valve to sleeve.
3. Open tapping valve all the way.
4. Bolt "CL-12" to tapping valve.
5. Make cut into main (as shown above).
6. Close tapping valve completely.
7. Remove drilling machine.
8. Attach branch main to tapping valve.
9. Open valve to put branch in service.

The use of Mueller "quality-matched" equipment eliminates the need for extra adapters and fittings and reduces set-up time. The automatic power operation of the CL-12 Machine reduces cutting time, too, and completely frees the operator for other work around the job-site while the main is being cut. *Total on-the-job time is greatly reduced.*

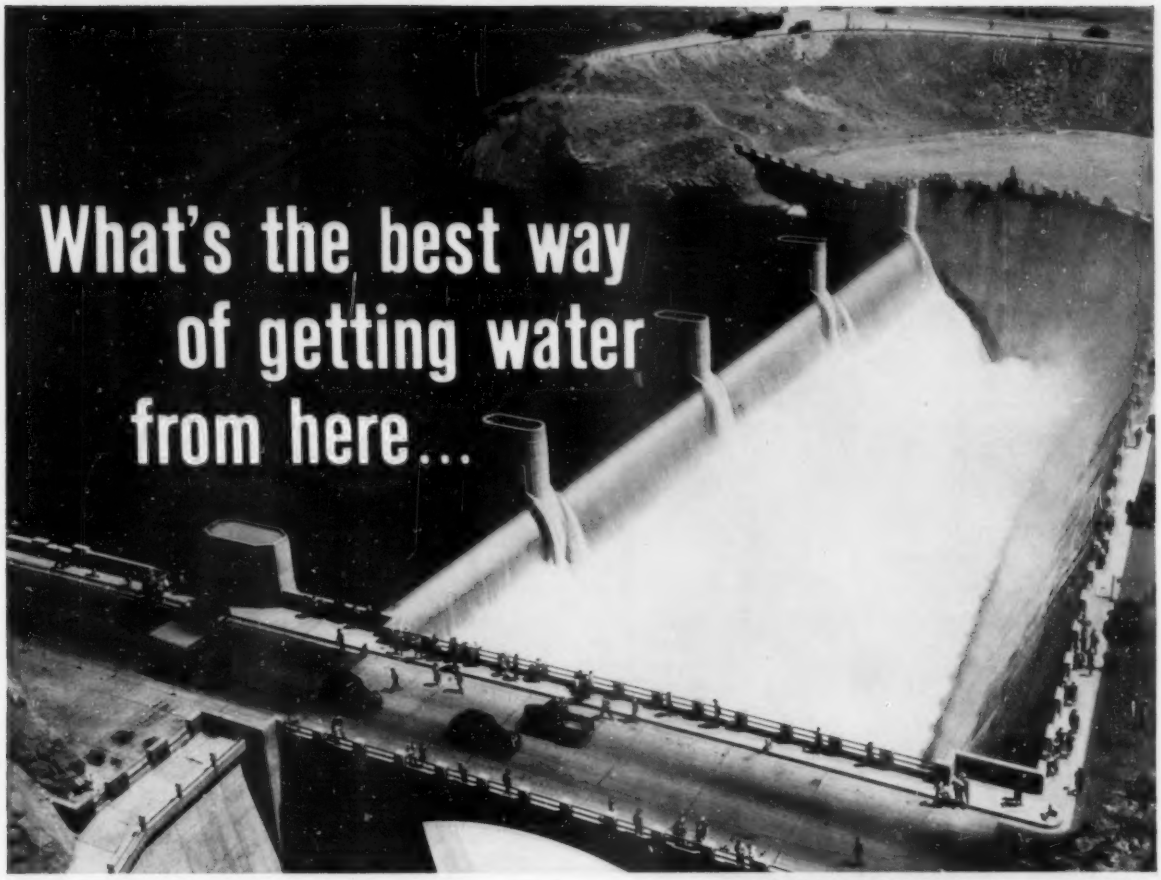
Write for complete information.

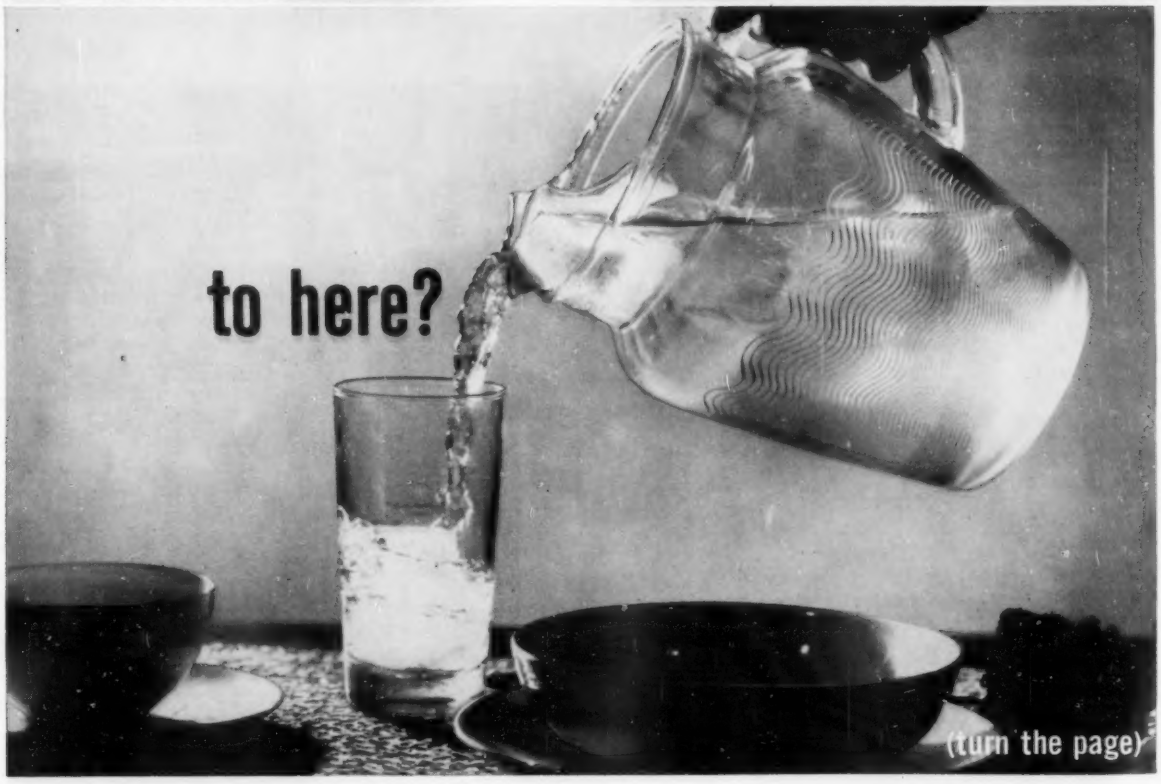
Calked or mechanical joint type sleeves and valves are available in a full range of main and and branch main sizes.
The "CL-12" may be hand operated with a ratchet handle or power operated with an air motor (shown) or gasoline engine drive unit.

MUELLER CO. since 1857 SERVING the Water and Gas Industries QUALITY

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario


What's the best way
of getting water
from here...


to here?
(turn the page)

CAST IRON PIPE

America's greatest water carrier

Installation of 2000 feet of 12-inch mechanical joint cast iron pipe along state highway.

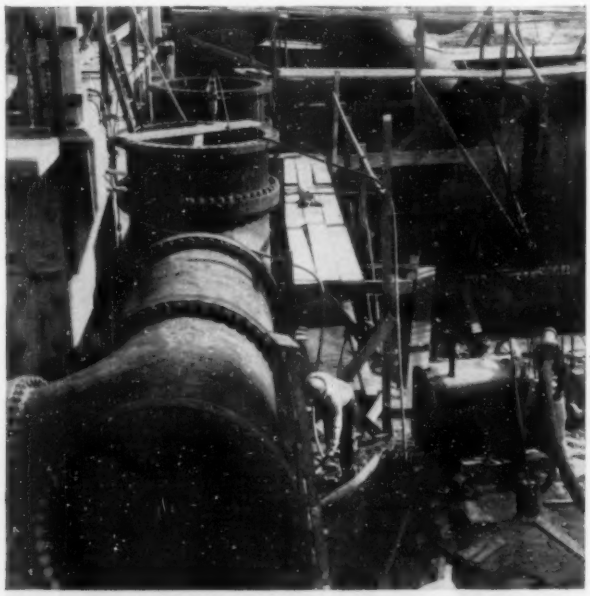
Why do we say that?

This year, as every year, more miles of underground cast iron water mains are in use than all other kinds of pipe combined.

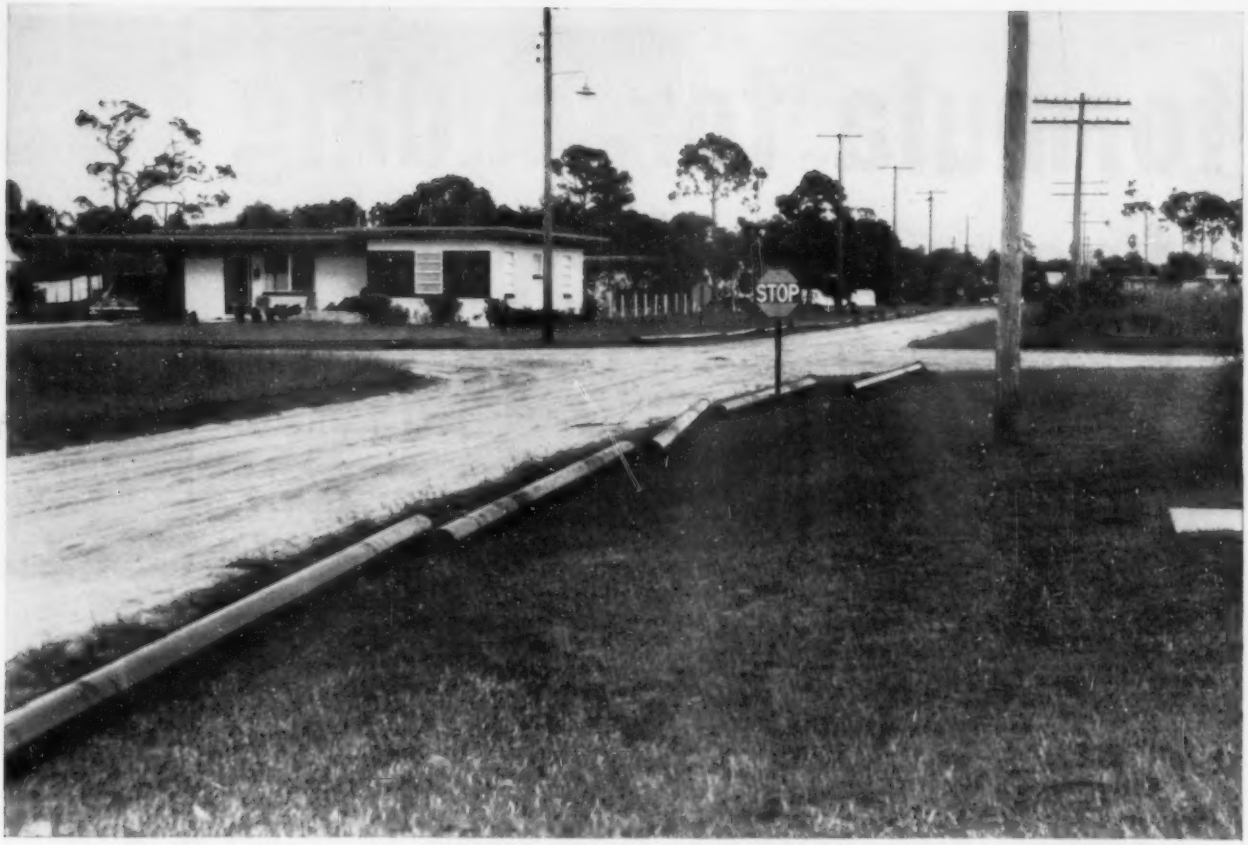
Furthermore, more miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

Yes, cast iron is always the favorite. A recent impartial survey showed that consulting engineers and water utility officials prefer cast iron pipe for underground water distribution by an overwhelming majority.

Eight-inch cast iron pipe ready for installation of 2-main water system in new subdivision.



Installation of 60-inch flanged pipe and fittings for circulating condenser water in a power plant.



Major additions to a municipal water system totaled 116,080 feet of slip-on joint cast iron pipe in 6-, 10- and 12-inch sizes.

Private water company main extension of 6-inch slip-on joint pipe for housing development.

What are its advantages?

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
- HIGH-CAPACITY FLOW. Cement-lined cast iron pipe will deliver the full-rated flow all through the years. No other pipe, size for size, can carry more water.
- CORROSION RESISTANCE. Long life proves it. Most water utilities are still using the first cast iron pipe they installed.
- GREAT BEAM STRENGTH. Cast iron pipe resists the effect of heavy traffic, shifting soils.
- TREMENDOUS LOAD RESISTANCE. Six-inch cast iron pipe (Class 150) withstands a load of nearly nine tons per foot!
- PRESSURE-TIGHT JOINTS. You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- EASE OF TAPPING. No tapping saddles needed. Takes threading best of all kinds of pipe.

. . . good reasons for <u>you</u> to choose

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

formula for ending stream pollution!

TRICKLING FILTERS + TFFI UNDERDRAINS = CLEAN WATERS

Trickling Filters' 6 great advantages

Low initial cost, low operating cost and long-term maintenance costs. Overloads are no problem. Give top-notch effluent. Minimum of operating personnel required

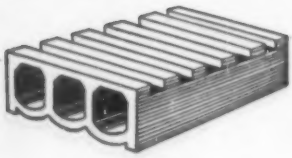
VITRIFIED CLAY UNDERDRAINS' GREAT ADVANTAGES

The most important part of a trickling filter is the underdrains. When built of vitrified clay blocks made to TFFI specifications they will safely carry highest hydraulic loadings. They alone can withstand all the ravages of acids, alkalis and bacterial action. They are made in modern plants under rigid controls of quality that are impossible with any substitute materiai. Only they offer you a 50-Year Guarantee against damage by acids and bacteria.

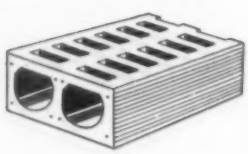
Leaders in ending stream pollution

TFFI members are proud of their part in providing clean waters for America through their contribution of superior vitrified clay filter floors. Over 35% of the population is now served by more than 2,700 sewage works with trickling filters. This number is constantly growing as more and more engineers discover their superiority.

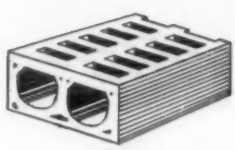
TFFI TRICKLING FILTER



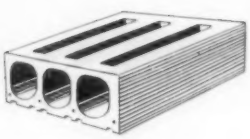
TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

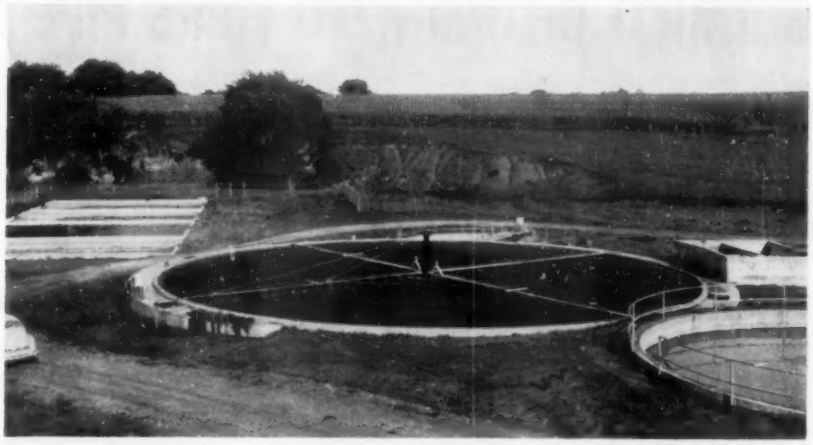


BOSCO
Bowerston Shale Co.
Bowerston, Ohio



NATCO
Pittsburgh 22, Pa.
327 Fifth Ave.
Natco Corporation

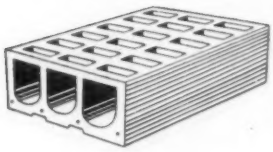
Trickling filter floor of vitrified clay TFFI specification blocks at Fort Worth, Texas. Consulting Engineers, Freese and Nichols, Fort Worth. Major equipment by Infilco, Inc. and Process Engineers, Inc.



Trickling filter at Knoxville, Iowa • Has TFFI Specification vitrified clay blocks • PFT rotary distributor shown.

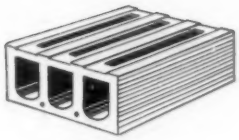
Address any member of the Institute for full details and suggested specifications for blocks.

FLOOR INSTITUTE



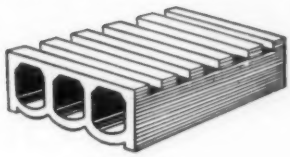
DICKEY

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



POMONA

Pomona Terra-Cotta Co.
Pomona, No. Car.



TRANSLOT

Cannelton Sewer Pipe Co.
Cannelton, Ind.

The Federal Government Sets the Standards...

"Bituminized-fibre sewer pipe and fittings," says the government, "shall resist the action of organic matter, alkalies, and acids normally existing in soils and sewage." The Federal Specification goes on to list performance requirements for *water absorption, crushing strength, chemical and kerosene resistance, hot water resistance, heat resistance, resistance to flattening,* and *beam strength.*

BERMICO BITUMINIZED FIBRE PIPE *EXCEEDS* THEM!

Federal Specification SS-P-356 established strict standards for bituminized fibre pipe used for sewer lines. Bermico easily exceeds those standards. That's why code authorities across the nation are including Bermico pipe in their codes.

Bermico surpasses *all* these requirements. What's more, it's lightweight, easy to handle, and rootproof. And Bermico is the only bituminized fibre pipe with a full line of fittings — wyes, tees, and bends — of the same material.

For full details about Bermico . . . and for information about communities that have included bituminized fibre pipe in their codes . . . write Brown Company, Dept. 1109, 150 Causeway Street, Boston 14, Mass.

Another Quality Product of

BROWN COMPANY

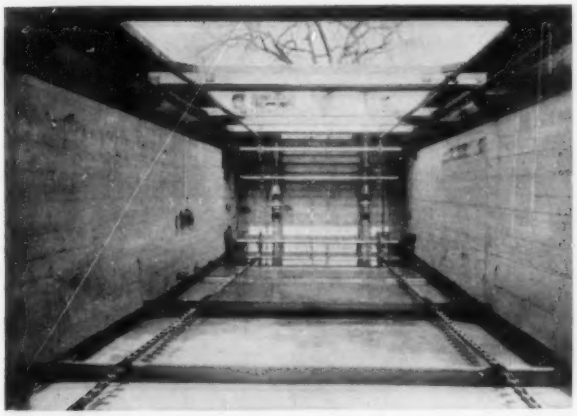
General Sales Offices: 150 Causeway Street, Boston 14, Massachusetts
Mills: Berlin, N. H. • Birmingham, Ala. • Corvallis, Ore.

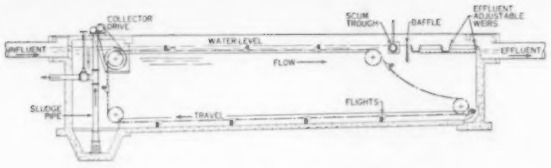
WHICH SLUDGE COLLECTOR

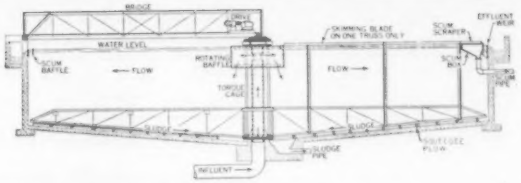
can do the best job for you?

For maximum efficiency . . .
minimum disturbance of flow . . .
choose LINK-BELT
STRAIGHTLINE sludge collectors

For large installations
where construction economies
are vital . . . it's LINK-BELT
CIRCULINE sludge collectors







STRAIGHTLINE COLLECTORS are scraper conveyors made in various styles to handle sludge and scum in *rectangular tanks*. Straightline design means the shortest possible travel for the collected material. It also permits a steady slow speed of the collecting flights that is uniform over the entire floor surface of the tank. This results in maximum efficiency with minimum disturbance to the flow. Straightline collectors can also be installed in the Link-Belt Uniflow settling tank—an improved rectangular design combining a rapidly sloping bottom with a system of multiple effluent weirs.

CIRCULINE COLLECTORS are installed in either rectangular or round tanks. Link-Belt offers four series—R, S, T and C. Series R are usually installed in circular tanks and are used to remove settled sludge from the tank floor and scum from surface of liquid. Series S are for square tanks, or rectangular tanks where sludge is collected only from the influent end of tank. Series T are similar to Series R, except they are built to withstand torques encountered in removing heavy settled solids. Series C have both the economical feature of circular tank construction and the positive sludge and scum collection of a straightline sludge collector.

Sludge collectors are only a part of the broad line of Link-Belt sanitary engineering equipment. Get in touch with the Link-Belt office nearest you. Our sanitary engineers will be glad to work with your engineers, chemists and consultants . . . help you get the finest in modern treatment methods. Or write for Water, Sewage and Industrial Waste Treatment Equipment Book 2617 and Uniflow Settling Tank Folder 2648.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

15,000

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World.

See our exhibit, Federation of Sewage and Industrial Wastes Assns., Memorial Auditorium, Dallas, October 11-15

One man and a Model D . . .

. . . all the crew your community needs on scores of jobs

Talk about variety. The low-cost Allis-Chalmers Model D can tackle more jobs in your community than any other motor grader. There's plenty of power for all regular grading work, plus optional equipment to handle jobs that would otherwise require special one-purpose units.

And your budget never had it so good. All this ability is still available at less than half the cost of a big machine. Look how some communities use their D's.

Cleaning ditches. A Model D can handle all kinds of grading . . . in a ditch, on a city street, on a farm road. The ROLL-AWAY moldboard picks up and moves bigger loads. You get more done than you'd expect with a machine this size. Front-wheel lean and power circle turn are available as optionals to increase load-handling ability and operator convenience.

move ahead with ALLIS-CHALMERS . . . .

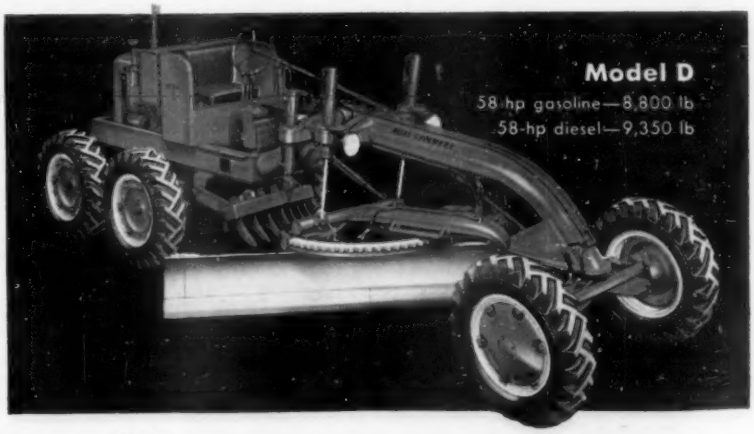
Snow clearing. The D's fine, sure control moves snow away from curb . . . 1-yd snow bucket loads it for disposal. Blade or V-type plows are also available for clearing work on outlying roads.

Road shoulder maintenance. A Model D does it in half the time, at half the cost. The D, with maintainer, lets one man do a complete, one-pass job on many miles of shoulder.

Scarifying. This 7-tooth attachment has 4,900-lb hydraulic down-force to scarify a 27¾-in. swath. Unique midship mounting lets you retain good steering control.

Loading. This D loads trucks, cleans road rubble, stockpiles. The ¾-yd bucket dump height of 8 ft, 8½ in. loads the largest trucks.

Check a Model D against your community needs. Here is a truly all-round, low-cost machine—proved by thousands of users. It's the economical way to put roads in top shape—and handle many other jobs as well. Your dealer will show you one in action. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.



ROLL-AWAY is an Allis-Chalmers trademark.

... power for a growing world

RIDGID No. 2-S
Spiral Reamer
⅛" to 2" Capacity . . . Self-Feeding for Least Effort

For Smooth, Easy Reaming it has to be
RIDGID

No. 2
⅛" to 2" Capacity

No. 3
⅜" to 3" Capacity

RIDGID
"LonGrip"
Reamers

No Thinned or Flared Walls

Take your choice–Spiral or "LonGrip"–you can't beat these RIDGID Reamers. For hand reaming, you probably prefer the effortless self-feeding Spiral; for power use, the "LonGrip" five-fluted reamers. Heat-treated cutting edges offer extra-long service . . . will not dig in and thin or flare walls. All RIDGID Ratchet Reamers come equipped with handle.

Your Supply House has them. For smoother, faster reaming, order yours today.

RIDGID

PUBLIC WORKS

Walter M. Franklin is General Superintendent, Charlotte, North Carolina Water Department and Sewage and Industrial Waste Treatment Works. As such he is responsible for all operations of the Water Department, including planning for future expansion. In addition he is responsible for the operation, maintenance and plans for expansion of all sewage treatment works and industrial waste treatment. He has held this position since 1947. From 1936 to 1947 he was in charge of all water treatment plants and pumping stations and all sewage and industrial waste treatment works for the City of Charlotte.

He is a graduate of the University of North Carolina, BS in CE and MS in Highway and Sanitary Engineering. He joined the staff of Wm. M. Piatt, Consulting Engineer, (now Piatt and Davis), in 1927 and continued with this firm until 1934. In 1934 became Chief Chemist of the Durham, N. C, Water Department which position he held until 1936 when he went to Charlotte.

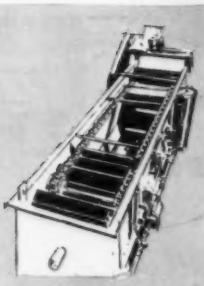
He served as Captain and Major in the Sanitary Corps of the U. S. Army during World War II, seeing service in the Western Pacific area. Upon being released from service, he returned to the Charlotte Water Department in 1946.

Since 1947, the City of Charlotte Water Department has expanded its facilities for water supply treatment and distribution from a capacity of 16 mgd to 37 mgd. The latest addition to the pumping and treating facilities is the new Hoskins Filter Plant. Both of the City's sewage treatment works have been enlarged and modernized to a total capacity of 21 million gallons per day. These plants were redesigned and built to handle industrial waste, in addition to the domestic sewage. The water distribution system has also been reinforced to take care of the abnormally fast growth of the City of Charlotte for the past twelve years. At the present time the City is preparing to annex on January 1, 1960 an area of 36 square miles which will approximately double its present size. Construction programs are under way to extend the water distribution system into these areas. Some of the extensions recently installed are 42" distribution system supply mains.

Mr. Franklin is a licensed professional engineer and a member of the NSPE, the AWWA and the FSIWA. He is past Chairman of the N. C. Section of the AWWA and FSIWA, and is past Director of both AWWA and FSIWA. He is Diplomate of the American Academy of Sanitary Engineers, and has served for several years as a member of the Industrial Committee of the local Chamber of Commerce, representing the City's water and sewage utility. He is a Reservist in the BDSA.

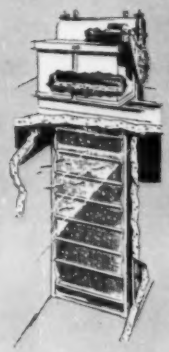
He is a member of the Dilworth Methodist Church. He and Mrs. Franklin have one boy, age 19, an engineering student at The Citadel, Charleston, S. C. His principal hobby is golf.

CHAIN BELT COMPANY

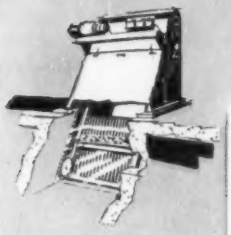


Typical modern waste treatment plant completely equipped with REX Sanitation Equipment.

REX FLOAT-TREAT... Treatment by dissolved air flotation.

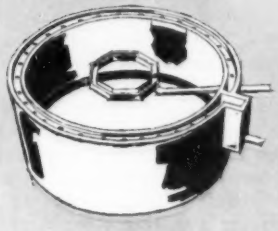


TRAVELING WATER SCREENS ...Fine screening for process or waste water.

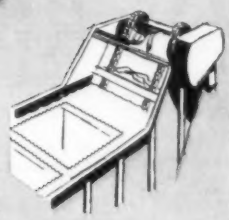


REX BAR SCREENS... Coarse screening for large solids removal.

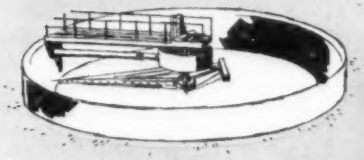
REX WASTE TREATMENT EQUIPMENT ASSURES PROVEN PERFORMANCE...MAXIMUM ECONOMY... SOUND ENGINEERING...MODERN DESIGN



REX RIM-FLO CLARIFIERS... Maximum settling efficiency in a circular tank.



REX VERTI-FLO CLARIFIERS...Maximum settling efficiency in a rectangular tank.



REX SLUDGE COLLECTORS...Suction or scraper type...round or rectangular tanks.

Whatever the problem in waste treatment, whether it's the removal of solids or the recovery of valuable products, CHAIN Belt Company is ready with the economical answer...an answer developed through nearly 30 years of practical experience and research.

CHAIN Belt offers the best in modern methods of waste treatment as well as a complete line of modern, quality equipment.

Rex can offer the right type and size for nearly every requirement, from a tiny steel tank package plant to the largest multi-unit concrete tank installation.

Flexibility in choice of process and equipment assures the lowest possible plant cost, lowest operating and maintenance cost consistent with top performance.

Rex processes and equipment reduce pollution, save valuable products and water with efficient use of space and facilities. Existing structures may often be utilized to provide modern treatment with slight modification.

The CHAIN Belt technical staff is prepared to assist in the evaluation of any waste treatment problem. Laboratory and field investigations will be performed and waste will be analyzed for proper equipment selection. A laboratory test service is also available, as well as pilot units for field tests at the site.

Call the nearest Rex Field Sales Office for complete information on the waste treatment equipment shown here and many other types. Or write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.

REX®

SEWAGE AND WASTE TREATMENT EQUIPMENT

AIRPLACO

ADVANCED DESIGN EQUIPMENT SAVES DOLLARS ON CONCRETE WORK

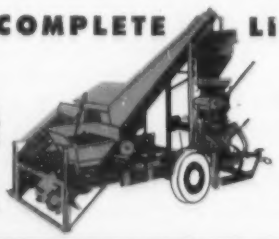
SAVE on bridge repair

SAVE on sidewalk and curb repair

SAVE ON ALL CONCRETE CONSTRUCTION AND RESTORATION WITH AIRPLACO

You save cold, hard cash when you use AIRPLACO "Advanced Design" concrete gunning and placing equipment. You save valuable time—speed up work. Save on labor—fewer men get more work done. Save on materials—get higher efficiency, more versatility. Investigate AIRPLACO for your next concrete job.

COMPLETE LINE



AIRPLACO offers you a complete line of concrete guns, portable mixers, grouters, placers, sandblasters and a complete line of accessories.

FREE CATALOG

AT YOUR SERVICE — Draw upon the experience of the world's leading manufacturer of pneumatic concrete placing equipment. Let us help you solve your concrete maintenance and restoration problems. Write, wire or phone, anytime.

AIRPLACO AIR PLACEMENT EQUIPMENT CO.

1013 WEST 24TH ST. • KANSAS CITY 8, MO.

WORLD'S LEADING MANUFACTURER OF "ADVANCED DESIGN" PNEUMATIC PLACING EQUIPMENT

HIGHWAY SYSTEM CLASSIFICATION

This report by the Highway Laws Committee of the Highway Research Board concerns the primary highway systems of the 50 states and Puerto Rico. It is the first of a series of studies on the subject of highway classification, and will be followed by other reports covering state secondary systems, and county, township, municipal and other local systems. This report was researched and prepared by Marion Markham, of the Bureau of Public Roads, and Karl S. Vasiloff, of the Highway Laws Project staff. Copies of Special Report 42 are $3.20 each and are available from Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

1959 ARBA DIRECTOR OF HIGHWAY OFFICIALS AND ENGINEERS

More than 1,700 names, titles and addresses of administrative engineers and officials in the 50 state highway departments, the District of Columbia and Puerto Rico are listed in this pocket-sized directory. Also included are administrative personnel of the Bureau of Public Roads and toll road authorities. Copies at $1 each are available from American Road Builders' Association, World Center Bldg., Washington 6, D. C.

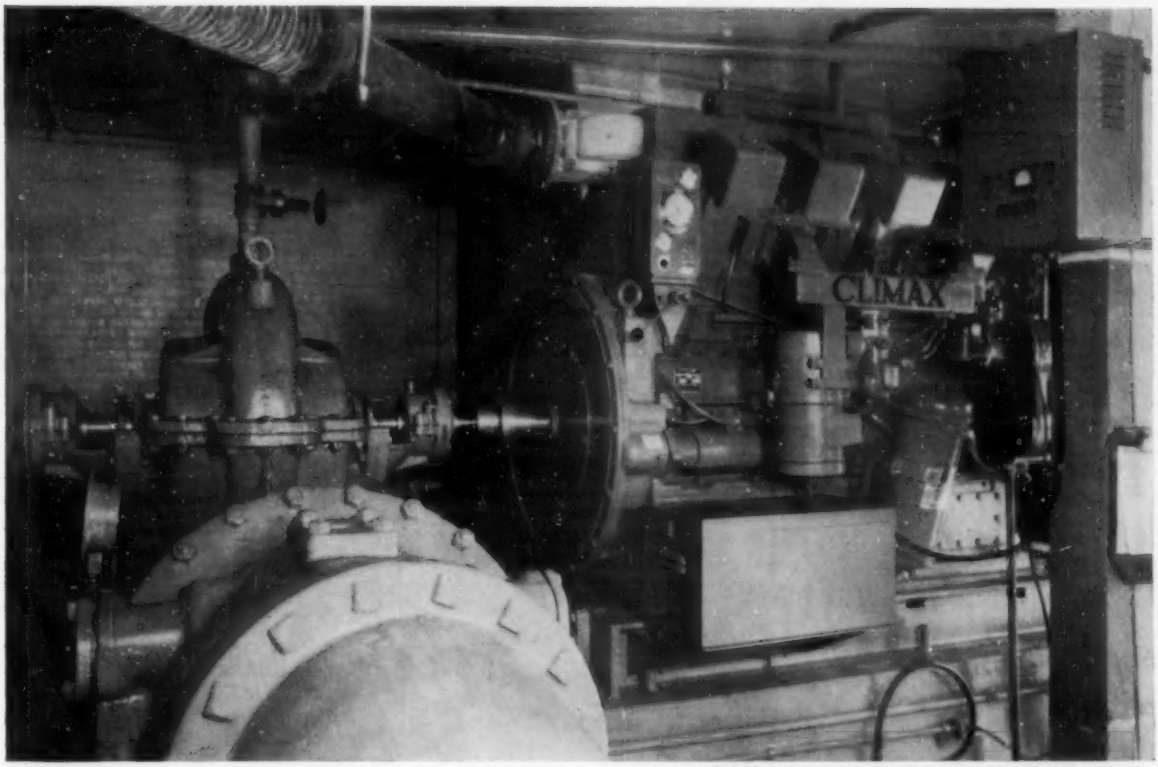
SUMMARY OF ENGINEERING RESEARCH AT UNIV. OF ILLINOIS

"A Summary of Engineering-Research 1957-1958" published by the University of Illinois Engineering Experiment Station, 114 Civil Engineering Hall, Urbana, Ill., is intended to serve as a reference concerning engineering research at the University, and to list the men engaged in the individual projects and the publications that have grown out of this research during July 1, 1957 to July 1, 1958.

AGC OFFERS THREE NEW PUBLICATIONS

The Associated General Contractors of America has announced

in an emergency...



ENGINE INSTALLED BY POWER SERVICE CO., ATLANTA, GEORGIA

in case of fire and power failure

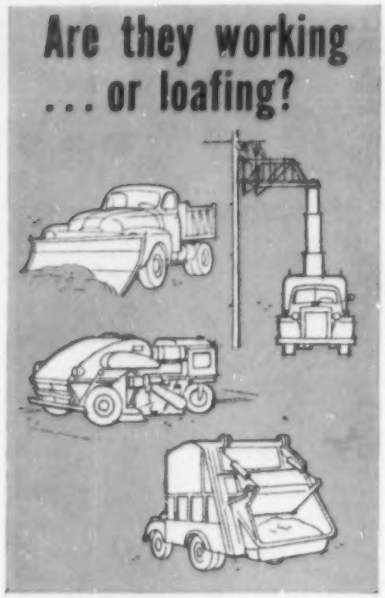
CLIMAX V-85 ENGINE DRIVES PUMP

to protect the Georgia Division Plant of LOCKHEED AIRCRAFT CORPORATION

The largest aircraft plant under one roof in the United States—Air Force Plant No. 6 at Marietta, Georgia—is operated for the Air Force by Georgia Division of Lockheed Aircraft Corporation to build C-130 Hercules Cargo-Troop Carriers. Here—ready for emergency—is a Buffalo 10" Class S double suction pump with 22½" diameter impeller, driven by a V-85 Climax 390 hp engine. With its minimum capacity of 4500 gpm at 100 psi discharge head, this unit will go into action pumping water in the event of fire and a power failure. The V-85 Climax Engine—8-cyl., 60° V-type, 7½-in. bore x 7-in. stroke, 2474 cu. in. displ.—burns butane or natural gas. Fuel economy is built in. The unusual compactness of Climax V-8 design means more power packed into less space. Rugged, too, for durability with dependability in continuous duty utility plant pumping and generator service. For all its plus-value features get Bulletin SA-584.

CL-110

CLIMAX ENGINE MANUFACTURING CO. • DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY—CLINTON, IOWA



FIND OUT

If your equipment is working a full day!

SERVIS RECORDERS show "idle time" and "busy time"

Exactly!

Guard against costly inactivity! Install tamperproof Servis Recorders on street cleaners, dump trucks, front-end loaders and municipal and county fleets.

A clock mechanism turns a chart on which is accurately recorded the length of all stops and delays as well as the working time of all equipment. Engine idling time, too, can be recorded distinctly so that fuel economies can be effected.

Permanent records made for one day, three day, or weekly periods.

Used by progressive commercial truckers for 46 years ... *The low cost will surprise you!*

Ask for the name and address of Mr. S-R, our nearest qualified representative, for help on your problems or write for our new "Off-the-Highway Bulletin"

THE SERVICE RECORDER COMPANY
10138 Rockwell Ave. • Cleveland 14, Ohio

the availability of three new publications which are expected to be of value to architects, engineers, contractors, and construction contract awarding authorities. They include: "A Recommended Guide to Bidding Procedure on Engineering Construction," an up-to-date reference and procedural document for use in competitive bidding on engineering construction projects: "A Suggested Guide to Bidding Procedure on Building Construction," which basically establishes the recommended practices for use in competitive lump sum bidding for private work and is also applicable on public work where requirements permit; and an "Insurance and Bond Check List," which includes the type of insurance and bonds which are commonly used by general contractors. Individual copies of these documents may be secured without charge from the AGC at 20th and E Streets, N.W., Washington 6, D. C. Quantity prices will be furnished upon request.

MAN VERSUS ENVIRONMENT CONFERENCE

A conference on "Man Versus Environment" was held in 1958 to review and evaluate problems of public health resulting from new developments in science and technology. The conference was sponsored by the National Institutes of Health and the Bureau of State Services of the Public Health Service, to focus attention on the research needs in the major fields of water supply, water pollution, air pollution, food technology, and occupational health. Principal speakers were Henry F. Vaughan, Robert A. Kehoe and Abel Wolman. The published Proceedings include papers presented by Harry E. Jordan, Mark E. Hollis, Jack E. McKee, Ralph Fuhrman, Emil Mrak, Walter Tiedeman, Leslie A. Chambers, Louis C. McCabe and James H. Sterner. Copies are available upon request from: Research Grants Coordinator, Division of Engineering Services, Public Health Service, Washington 25, D. C.

PHILADELPHIA'S CAPITAL PROGRAM

The Capital Program of Philadelphia, Pa., is a statement of the future policy of the city on long-range physical development. In Philadelphia, this program covers a 6-year period, 1959-1964, setting the policy framework within which capital improvements will be undertaken. 180 pages, illustrated. Philadelphia City Planning Commission, Philadelphia, Pa.

CASE STUDIES ON 25 MAJOR DAMS

This is a 48-page booklet containing pictures and some data on 25 major dams in which Pozzolith, a concrete improving admixture, was used. Ask for Bulletin MBR-P3, Master Builders Co., Cleveland 3, Ohio.

PREVENTIVE MEDICINE IN WORLD WAR II

This is Vol. IV of the History of the Army Medical Department. It covers communicable diseases transmitted chiefly through respiratory and alimentary tracts. The first of three volumes on communicable diseases, the second portion of it will be of greater interest to engineers, but because the 21 authors do not (we believe) include any engineers, the presentation of material is rather unlikely to be of much engineering value. The remarkable record the Army made in controlling alimentary tract diseases should, however, make the text of interest and of some value to sanitary engineers. 544 pages; Government Printing Office, Washington, D. C.; $5.50.

SANITARY CODE FOR MARICOPA COUNTY

A new sanitary code, effective in April, 1959, was adopted by Maricopa Co., Ariz. This is an excellent job and represents one of the few modern codes. In addition to the usual general provisions in Chapter 1, it covers: Disposal of wastes, 17 pages; vector control and pesticides, 2 pages; land subdivisions, 1 page; domestic water supplies, 2 pages; swimming pools, 11 pages; health examinations, 1 page; foods, food products and food handling, 24 pages; trailer parks, 7 pages; housing, community sanitation and public buildings, 4 pages; and animals, Department also acts for the city of 3 pages. The Maricopa Co. Health Phoenix, Ariz.

CONCRETE PAVEMENT DESIGN RESEARCH

This 49-page bulletin contains two papers presented at the 37th Annual Meeting of the Highway Research Board. The first, entitled "Fifteen-Year Report on Experimental Concrete Pavement Project in Oregon," by G. S. Paxson, deals with a portion of the northeast Portland secondary highway paved in 1941, with facilities for measuring performance of expansion and contraction joints at various spacings, with and without load transfer devices; and the

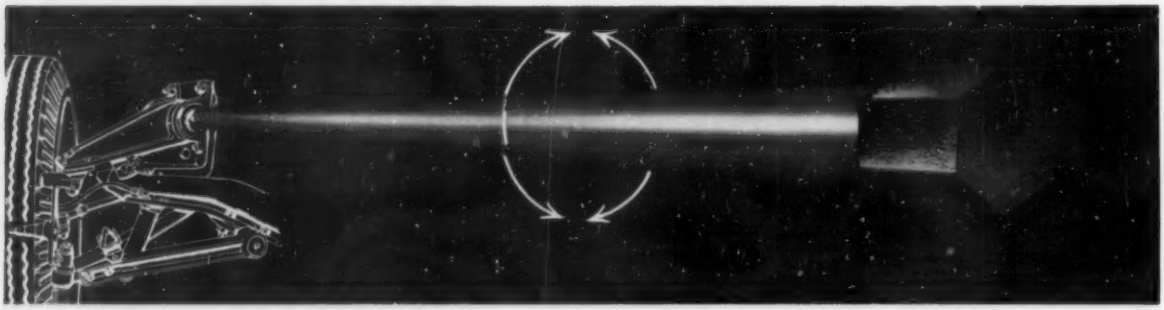
(*Continued to page* 210)

ANNOUNCING
Chevrolet trucks for 1960 with total newness!

Here comes the biggest improvement in trucking in decades . . . a revolutionary improvement that can make any truck route in America a far smoother road to bigger profits for you. Turn the page for the hottest news for truckers since coffee was invented!

new torsion-spring ride!

THE SMOOTHEST THING THAT EVER CAME BETWEEN A ROAD AND A LOAD!



Independent front suspension with tough torsion bar springs . . . for trucks! Years in the making, this totally new suspension system protects everything from bumps and jolts . . . provides a new kind of performance that lengthens truck life, protects cargoes, reduces driver fatigue and cuts maintenance expense to new lows. Independently suspended, each front wheel steps cleanly over bumps. And the friction-free torsion bars work to absorb each jolt or jar; they flex freely, even on the smallest bumps, yet have the capacity to absorb severe shocks. The result is a truck ride so wonderfully smooth that it must be experienced to be believed! And it's now *standard* in *all* classes of 1960 Chevrolet trucks!

Three tailored-to-the-truck rear suspensions complement the revolutionary torsion bar independent front suspension. *In Series 10 and 20 models,* frictionless high-capacity coil springs ease the rear axle over bumps. *In Series 30* and 40 models,* a new two-stage leaf spring provides tailored springing action . . . *and in Series 50, 60, 70 and 80 models,* all-new variable-rate rear suspension gives spring resistance that adjusts automatically to cushion any size load.

**Optional at extra cost.*

Chevrolet trucks for '60

new style, new models!

NEWLY ENGINEERED FOR EXTRA SAVINGS THROUGH EXTRA STRENGTH!

Rolling in on revolutionary torsion springs, these 1960 Chevies are smooth as silk yet tough as nails . . . totally new in scores of profit-boosting ways! In the light-duty class, for example, big new Series 40 chassis-cabs and stakes add to your earning power with G.V.W's up to 14,000 lbs. And virtually every model offers a new lower-to-the-ground build (without sacrificing road clearance) which improves truck stability and makes cab entry easier. In the big-truck class, too, Chevy for '60 sports big-profit G.V.W.'s – up to 19,500 lbs. in middleweights and 36,000 lbs. in heavyweights – with stronger components including new frames with more massive bracing and brawnier side rails, new bigger brakes, and the latest in low-cost V8 or 6-cylinder power.

New Comfort-King Cabs! There's more comfort than ever before, with 5 inches more shoulder room, 6 inches more hip room and more leg room and head room, too! A new wider seat, combining S-wire, coil and flat spring elements, offers a new high in easy riding. And Chevy's new double-walled cowl and new double-panel roof construction provide extra ruggedness and long life.

New custom cabs! Available in all 1960 cab models, they include distinctive exterior door pillar and rear belt line moldings . . . handsome chrome grille (light-duty models) . . . new Super Cushion Seat with foam seat cushion and backrest . . . sunshade, armrest, cigar lighter and control knob trim.

New compact L.C.F. models! Twenty-six new Chevrolet Low Cab Forward models with short cab design allow for maximum length trailers and extra cargo space. Short wheelbase and turning radius give exceptional maneuverability. Bumper-to-back-of-cab dimension is as short as 90 inches. G.V.W.'s go up to 25,000 lbs. and new cab design makes entering easier. And in series 50 and 60 models you can choose 6-cylinder or V8 power.

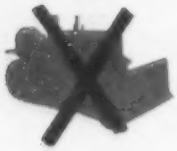
New tougher built tandems! They're the best built Chevy tandems yet with Hendrickson RT320 rear suspension, two 16,000-lb. Eaton rear axles and 7,000-lb. front suspension (9,000-lb. front suspension optional, extra cost).

And they're POWERED to improve your profit picture, too! Chevy for '60 offers a *wide* choice of better-than-ever power plants; in every weight class you can choose from famous economy 6's or V8's that lead the field for efficient short-stroke design! Three big sixes and four advanced V8's allow you to match the engine to your job for top performance.

Chevy's 1960 trucks with *total newness* are now on display at your Chevrolet dealer's, so stop by sometime soon! . . . Chevrolet Division of General Motors, Detroit 2, Mich.

CHEVROLET

with total newness!



Can your loader lift its lip and duplicate dozer action? No?

Then trade it off without delay! Because your city will miss cost-cutting opportunities right and left without this *big-capacity* 4-in-1 action. "Radius control" gives positive control of dozing depth; and there's built-in strength for hard digging. This TD-20 4-in-1 is dozing on a heavy grading job.

Can your loader strip, grade, and "boil" itself full on-the-go like a carry-type scraper? No?

Then consider what extra service—and *extra-valuable service* your city could command—with versatile scraper-like action at a 4-in-1 operator's fingertips. This TD-20 4-in-1 is ditching in sticky clay soil—note how easily this action could prepare a trench for storm sewer or culverts!

Only a clam-action 4-in-1 doubles for a whole spread of "big-ticket" rigs

...GIVES INSTANT CHANGEOVERS!

At fingertip lever command, the International Droft 4-in-1 takes over the jobs of several costly machines. You simply move the selector lever from the operator's seat—stopped, or on-the-go—and get your choice of machine actions to do an unlimited variety of operations!

At left, the new 2¼ cu. yd. TD-15 4-in-1 is spreading "cover" uniformly on refuse that it leveled and compacted. Able to double for so many machines, the exclusive clam-action 4-in-1 spreads, levels, compacts, and covers refuse as no other outfit can—to fulfill the requirements of modern minimum-cost sanitary landfill waste disposal!

And beyond that, clam-action 4-in-1 job-range and capacity obsolete old-style, straight-bucket rigs, all over town! City and county officials the country over are proving the exclusive 4-in-1 deserves to be called the "40-in-1" because of the long list of limited-duty machines it can replace!

Compare an International Drott 4-in-1 to your present old-style "single-action" loader—and to excavating, dozing, spreading, and stripping equipment, too! First compare capacity. Then, match 4-in-1 pry-action break-out digging power against the others. Then see how the clam gives dozer, "carry-type scraper," and versatile clamshell action. Prove that exclusive, shock-swallowing Hydro-Spring cuts upkeep; prolongs equipment life. See your International Drott Distributor for a 4-in-1 demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL HARVESTER

INTERNATIONAL DROTT

Does your loader have measured, advertised pry-over-shoe breakout action? No?

It's the genuine and exclusive pry-action breakout that enables International Drott 4-in-1's to replace far costlier boom-type rigs, on jobs like breaking up and loading out old curbing and pavement. The TD-9 4-in-1 exerts a huge pry-action breakout force of 18,000 lbs.!

Can your loader "bottom-dump" and handle sticky materials? No?

Then retire the rig and go modern! Your equipment can't be "choosey" about the materials it handles—or be idled by adverse weather that makes materials sticky! But 4-in-1 bottom dumping eliminates the sticky materials problem—and provides a vital dumping height advantage over ordinary roll-forward buckets!

BASIC...

A BATH WAS AN OCCASION in Grandfather's day. Setting up the tub, heating bucketfuls of water was a chore even the fussiest usually confined to one day a week—Saturday night.

EVERYDAY IS SATURDAY TODAY. With clean, pure water... carried through cast iron pipe... the shower or bath today is an accepted part of American living.

U.S. PIPE

FOR WATER, SEWERAGE AND

U. S. PIPE AND FOUNDRY COMPANY

but better than ever today!

Mine-to-main control assures
U. S. Pipe quality in service

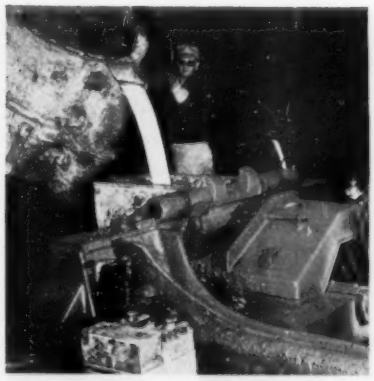
Water, harnessed and put to work, is the firmest base on which a community can build.

Water officials are doing an outstanding job keeping the nation's water pitcher filled. Cast iron pipe is their most dependable ally.

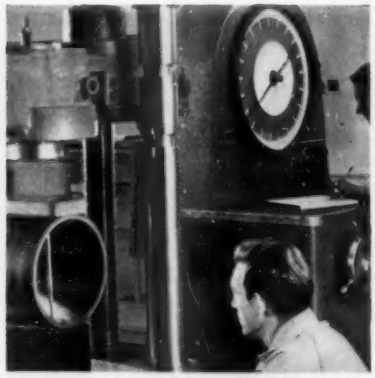
To furnish that dependability . . . in every detail . . . U. S. Pipe controls production every step of the way. From mine to final shipping U. S. cast iron pipe is subjected to intensive quality checks. . . checks to provide long life, efficiency, trouble-free service.

Quality is built into U. S. cast iron pipe.

CLEANING ORE. U. S. Pipe ore cleaning plant at a mine where ore is crushed and passed through separators to float off impurities.



MOLTEN IRON in a measured amount is poured into a machine ladle, preparatory to the start of the centrifugal casting cycle.



VIGILANCE. Specimens of U.S. Pipe are periodically subjected to a ring crushing test in a 200,000 pound universal testing machine.

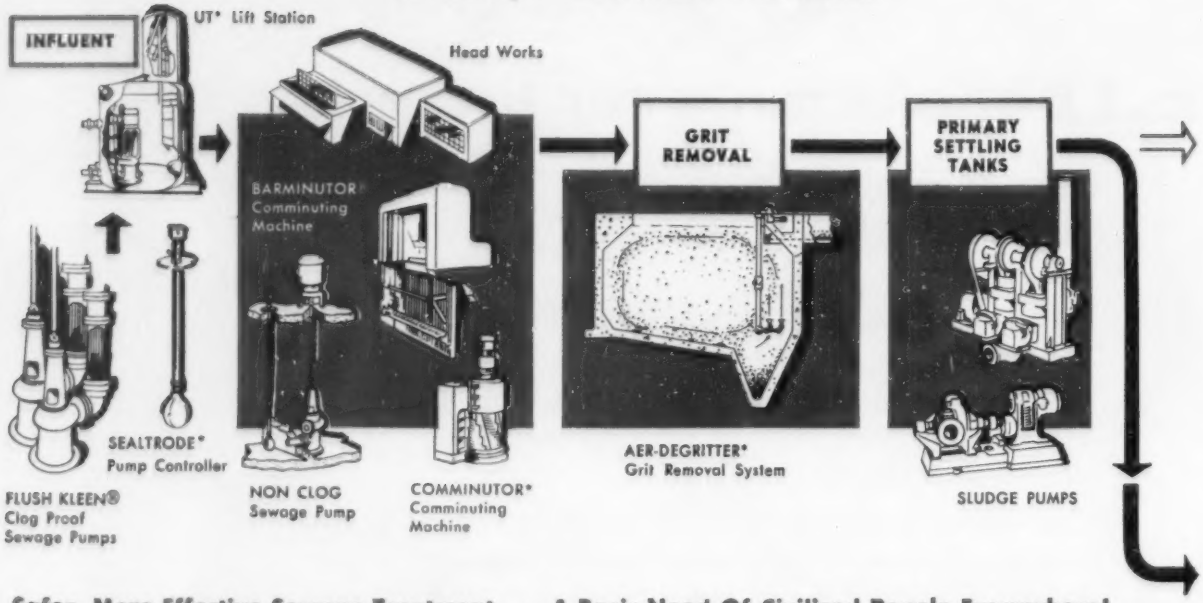
INDUSTRIAL SERVICE CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*

"from Chicago"

IMPORTANT 50 YEAR CONTRIBUTIONS

Primary Treatment Facilities



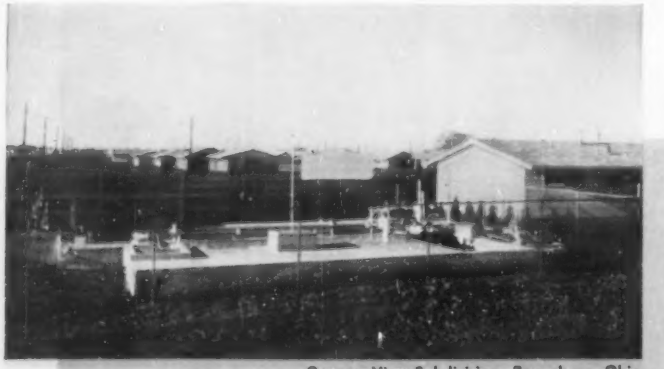
Safer, More Effective Sewage Treatment . . . A Basic Need Of Civilized People Everywhere!

1959 marks Chicago Pump Company's 50th year of continuous service to the field of Sewage And Industrial Wastes. We are indeed proud to have served the health, safety and welfare of so many people for so long . . . and look forward to even greater contributions in the next half century.

Illustrated are a few of the many "Chicago" products now in operation in thousands of installations throughout the United States and Foreign Countries . . . exclusive, proved equipment, systems and processes capable of solving any sewage problem. New products are in various stages of completion through our continuous program of research, engineering and development.

Service has been the very foundation of our success . . . based on a program of installation checking, operator supervision and training, as well as product application services to Consulting Engineers. An important dividend of these services has been the solution of an untold number of operating problems and the development of new and improved equipment, systems and processes.

*Trademark



German View Subdivision—Perrysburg, Ohio

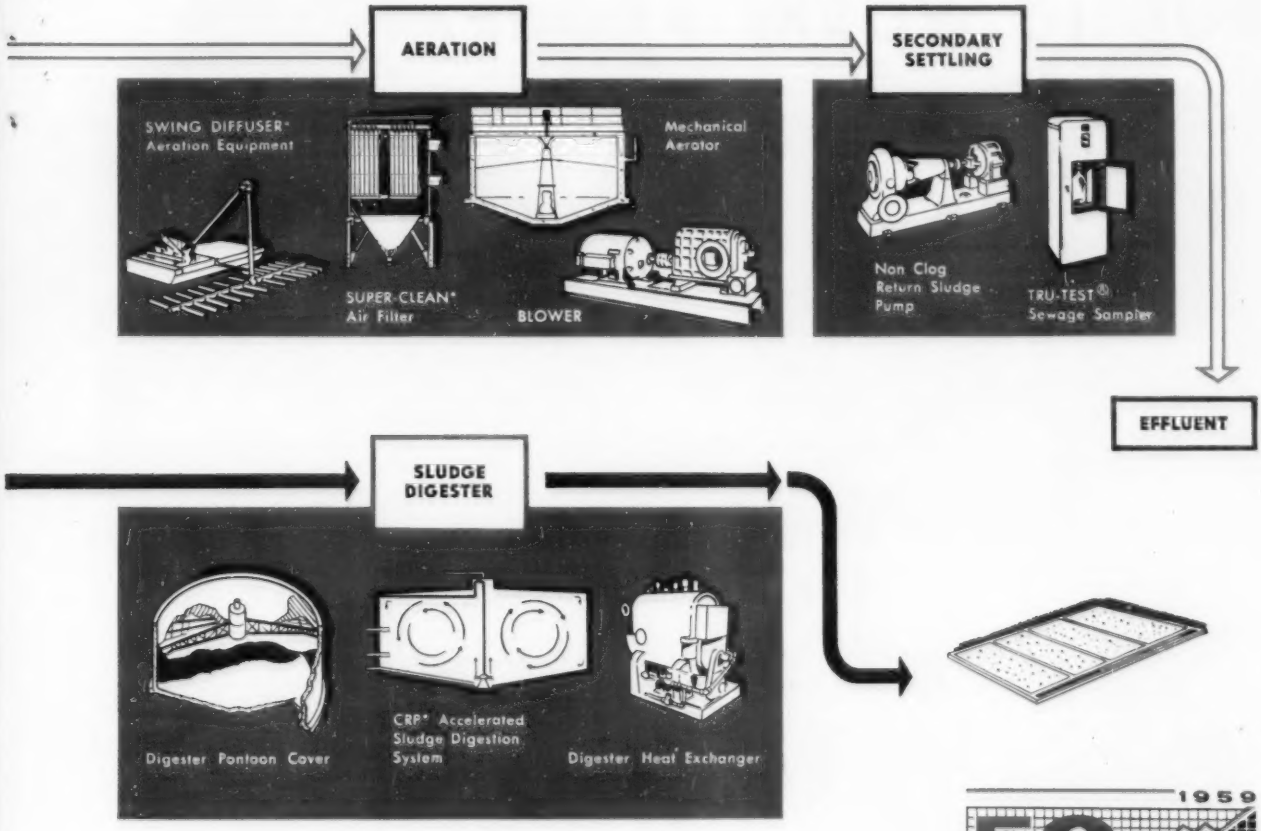
RATEDAERATION*

Small Unit Sewage Treatment Process Equipment For 20 To 5000 People

. . . one of "Chicago's" *newer* developments . . . designed to answer the increasing sewage problems resulting from the explosive growth of municipalities *outside the perimeter of metropolitan sewer systems.* Odor and nuisance free, low cost . . . for subdivisions, schools, etc.

TO THE FIELD OF SEWAGE AND INDUSTRIAL WASTES

Secondary Treatment Facilities



Distributors in Principal Cities Throughout the United States and Foreign Countries

1959 — 50 YEARS — CHICAGO PUMP COMPANY — 1909

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

622 H DIVERSEY PARKWAY · CHICAGO 14, ILLINOIS

©1959—CPCo.-FMC

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

New Line of Fire Hydrants

176. An 8-page bulletin 591 describing a completely new line of fire hydrants is available from Kennedy Valve Mfg. Co., Elmira, N. Y. Check the reply card for specifications on these hydrants.

Rotary Vacuum Filters For Sludge Dewatering

258. FEinc rotary vacuum filters for sludge dewatering feature continuous cake discharge by means of corrosion-resistant strings. Endless strings are placed ½" apart around the drum to dislodge the cake from the filter cloth. Bulletin 103 contains 24 pages giving application data, mechanical details, operating procedure and line drawings showing exploded views of parts. Write Filtration Engineers Div. American Machine and Metals, Inc., East Moline, Ill., or check the reply card.

Epoxy Resin Adhesives for Concrete

185. Thiokol LP-3/epoxy resin concrete adhesives are especially suited for use in maintaining or repairing concrete structures. Check the reply card or write Thiokol Chemical Corp., Trenton 7, N. Y., for details on testing and application and working properties.

Aluminum Pipe and Fittings for Portable Piping

204. Literature describing the use of aluminum pipe for supply or disposal lines that handle water is available from Aluminum Company of America, 1501 Alcoa Building, Pittsburgh 19, Penna. Check the reply card.

Propeller and Mixed Flow Pumps

253. Complete and detailed information, cut away drawings and delivery and performance tables are included in this bulletin from Layne & Bowler, Inc., Memphis 8, Tenn. Check the reply card.

Manual on Continuous Hollow Girder Concrete Bridges

245. This Manual is a follow-up of the Manual entitled "Continuous Concrete Bridges" and it applies to the design of hollow girder bridges. Check the reply card or write Portland Cement Association, 33 West Grand Ave., Chicago 10, Ill., for details on design method and procedure, details, substructure and forms and falsework.

Data on Griffin Cast Iron Pressure Pipe

268. Complete line of 20-ft. pipe in 4 to 12-in. diameters with a complete selection of pipe joints is described in literature from Griffin Pipe Division, Griffin Wheel Co., Council Bluffs, Ia. Check the reply card.

Engineering Data on Water Control Valves

278. Hydraulic piston and motor operated water control valves and altitude valves are described in bulletin from Wilgus Mfg. Co., 804 South Fair Oaks Ave., Pasadena, Calif. Check the reply card for engineering data.

Millipore Filter Used in Microfiltration and Analysis

279. This bulletin summarizes the characteristics of Millipore and Microweb filters, outlines their principal fields of use and describes apparatus designed to implement their application. For your copy check the reply card or write Millipore Filter Corp., Bedford, Mass.

Dotmar Pavers for Integral Gutters, Curbs and Sidewalks

286. Dotmar self-propelled curb and gutter paver is described in literature from Dotmar Industries Inc., 502 Hanselman Bldg., Kalamazoo, Mich. Check the reply card for full specifications.

Wire Cloth For Applications in Water and Waste Treatment

304. Series of articles covering industrial waste disposal and water treatment using diatomite filters make-up this bulletin from Multi-Wire Cloth Co. Inc., 1350 Garrison Ave., New York 59, N Y. Check the reply card.

Portable Jet Utility Pumps

310. These pumps are available in seven sizes, single and multi-stage, with capacity ranges to 2,520 gph. Check the reply card or write Barnes Mfg. Co., Mansfield, Ohio, for descriptive literature on these Sabre-Jet pumps.

Sanitary Refuse Compactor For Municipalities

311. Descriptive data, specifications and comparison figures on the Pax-It 16 and 20-yd. compactor units are covered in bulletin available from Pax-It Equipment Co., Inc., 814 2nd Ave. Bldg., Seattle 4, Wash. Check the reply card.

A New and Better Method of Burning Refuse

296. Advantages of incineration, industrial application, firing methods, design and performance of the C-E incinerator stoker are explained in literature. Check the reply card or write Combustion Engineering, Inc., Combustion Engineering Building, 200 Madison Ave., New York, N. Y.

More For Your Money With LeTourneau-Westinghouse Graders

299. Bulletin No. MG-155 is profusely illustrated with photographs and diagrams which tell about the operational and design features of the L-W motor grader line. Check the reply card or write L-W News Bureau, LeTourneau-Westinghouse Co., Peoria, Ill., for your copy.

Trickling Filter Blocks Feature Transverse Slots

302. TRANSLOT standard rate filter blocks are 18" x 11¾" x 4½" and TRANSLOT high rate filter blocks are 18" x 11¾" x 7¾". Both types incorporate 5 transverse slots and 3 large smooth surface ducts for maximum ventilation. Check the reply card or write Texas Vitrified Pipe Co., Mineral Wells, Tex.

How To Use Chemical Mixtures in Winter Maintenance

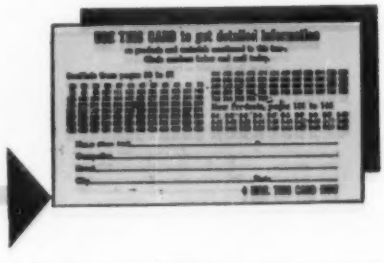
314. Purpose of this bulletin is to show maintenance personnel how to use mixtures of calcium chloride and salt in snow and ice control. Check the reply card or write Calcium Chloride Institute, 909 Ring Building, Washington 6, D. C., for full details.

Underdrain Blocks For Trickling Filter Beds

323. "Natco Tri-Filter" blocks are one piece salt glazed units, produced for both standard and high rate trickling filter systems. Shape details and sizes furnished in Bulletins TF-5 and TF-8, available from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Get the Facts on Conversion of Refuse to Compost

392. New process involving time and temperature control and accelerated by selective bacterial additives makes possible the conversion of refuse to a saleable compost in a continuous flow, 24-hour cycle. Illustrated Bulletin No. 158, "Bacti-Cycle Continuous-Flow Organic Waste Digesters," describes equipment, operation details and cost data. Write Earp Laboratories, Inc., Suite 2900, 29 Broadway, New York 6, N. Y., or check the reply card.



READY *for another load*

WHILE OTHERS ARE STILL SHIFTING GEARS

MASSEY-FERGUSON
WORK BULL 204

HAS EXCLUSIVE **INSTANT REVERSE** with TORQUE CONVERTER

In a race against time — to increase profits — no other industrial utility tractor can keep pace with the new Massey-Ferguson Work Bull 204. This 40-h. p. tractor has exclusive Instant Reverse with torque converter. You simply press one foot pedal to go forward — and another to go reverse. Acceleration is built in each pedal. Select one of four different gear ranges to fit your job requirements, and never waste time, power, or momentum in shifting, clutching, or pulling levers. The famous partners in profits — Massey-Ferguson Davis Loader and Backhoe — are designed to perfectly match the Work Bull 204. It's an unbeatable rig. Try it . . . compare it . . . you'll buy it!

PAYS OFF AT BOTH ENDS

Massey-Ferguson 220 Backhoe handles jobs with ease that others can't tackle. 14,000 lbs. breakout whips the toughest assignments. For flush digging, you can move the entire mast, boom, and seat to the side in only a few minutes. It increases your bidding power . . . reduces manpower.

Why Wait? Set a Date — We'll Demonstrate!

MASSEY-FERGUSON INDUSTRIAL DIVISION

Block 1000 South West Street • Wichita 13N, Kansas

To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Mercury Luminaires For Any Roadway Lighting Application

332. GE's new line of mercury luminaires for roadway lighting cover the 250, 400 and 1000-watt sizes. Check the reply card or write General Electric Co., Schenectady 5, N. Y., for application and photometric data and photographs.

Mechanically Operated Rakes For Sewage Bar Screens

345. Mechanically guided rakes with positive cleaning action and built in protection against excessive loads for mechanically cleaned bar screens are described in "Rack Rake" available from Newport News Shipbuilding and Dry Dock Co., Newport News, Va.

Solving Tunnel Concreting Problems

373. How excavating and concreting problems encountered on 12 major tunneling projects were solved is the subject of 20-page Catalog MBR-P8 available by checking the reply card or writing The Master Builders Co., Cleveland 3, Ohio.

Eimco-Process Flotators and Auxiliary Equipment

381. An 8-page two color bulletin describing flotation systems that are designed to accomplish difficult liquid-solids separations in the treatment of industrial wastes and domestic sewage is available from Process Engineers, Inc., 420 Peninsular Ave., San Mateo, Calif.

How To Measure Your Equipment Working Time

383. The Servis Recorder provides an accurate, permanent record to help you determine how effectively your equipment is being utilized. Tamperproof and easy to install, these recorders can easily lead to more efficient equipment operation. Get full details from The Service Recorder Co., 1015B Rockwell Ave., Cleveland 14, Ohio.

Mechanical Joint Tapping Sleeve and Valve

344. Smith tapping sleeve and valve answers the problem of making connections, in sizes 2 in. and larger, in water lines under pressure. Check the reply card or write The A. P. Smith Mfg. Co., East Orange, N. J., for full details.

Highway Pavement Marking Equipment

347. Stripers that are capable of applying single, double or two-color triple line stripes are described in literature from Kelly-Creswell Co., Xenia, Ohio. Machines are truck-mounted or self-propelled. Check the reply card.

Pneumatic Transmitters For the Water and Sewage Fields

350. Coordinated pneumatic rate of flow and loss of head transmitters, pneumatic rate of flow transmitters and pneumatic transmitters are covered in literature from Simplex Valve and Meter Co., Lancaster, Penna. Check the reply card for specifications.

Hardened Scraper and Dozer Cutting Edges

354. Literature is available from Caterpillar Tractor Co., Peoria, Ill., on scraper and dozer cutting edges and Cat-made router and end bits. Check the reply card for full details.

Bulletin on Vertical Close-Coupled Sewage Pumps

369. Bulletin contains suggested specifications and details of design and a large cutaway illustration with call-outs that gives a cross-section view of the sewage pump. Check the reply card or write Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo.

New Methods and Materials For Mounting Sweeper Brooms

393. Simplified core filling with long lasting plastic filaments is described in fact sheet. Write Rynal Corporation, 114 St. Joseph St., Arcadia, Calif., or check the reply card.

Pocket Transit is Handy To Have Along

387. The Brunton pocket transit for rough surveying can be used as a transit, level, plumb, clinometer, compass and alidade. Check the reply card or write Wm. Ainsworth & Sons, Inc., 2151 Lawrence St., Denver 5, Colo., for full details.

Keep Traffic Problems in Hand With Radio Controlled Porta-Signal

388. The Porta-Signal is self-contained in a compact aluminum carrying case and the battery operated unit fits into the trunk of any car. Write Porta-Signal Div., Dryomatic Corp., Alexandria, Va., or check the reply card for specifications and a wide range of applications.

Modern Accounting Control With Burroughs Accounting Machines

389. Accounting machines that can handle revenue and fund ledgers, budget reports, check writing, utility billing and payroll are described in literature from Burroughs Corp., Burroughs Div., Detroit 32, Mich. Check the reply card.

Underdrain Blocks For Trickling Filters

464. "Natco Unifilter" salt-glazed blocks for underdrains for trickling filter beds are balanced in size and weight for easy handling. Typical construction details for trickling filters of 20 to 160 ft. diameter are contained in a 16-page bulletin UF-3 from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Modernize Utility Systems with Telemetering and Remote Control

466. Remote control of switch gear, pumps, motorized valves, blowers, and transmission of metered data from remote points make possible supervision of plant units and water and sewerage systems from a central point. Details of the Centralized Operation Control system are available from Hammerlund Mfg. Co., Inc., 460 West 34th St., New York 1, N. Y., or by checking the reply card.

TRENCHES

2¾" to 8" wide • Depths to 6'
Self-Propelled•Hydraulic Drive
Low Cost • Pays for Itself!

The economic Arps Model M-A Trench-Devil will handle most of your trenching jobs faster, easier and at lowest cost per foot of trench. For the largest percentage of ditching work — foundations, water services, underground wiring, gas lines, sprinkler systems — this heavy duty, one-man outfit will outdig larger units costing many times its low price. Get more information *now* on this and other famous Arps Trenchers for larger and smaller jobs. The Arps Corporation, New Holstein, Wis. Dept. PW

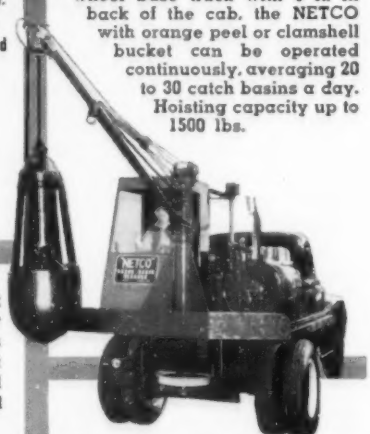
ARPS CORPORATION
NEW HOLSTEIN, WIS.

TRENCHERS
HALF-TRACKS • BULLDOZERS
UTILITY BLADES

NETCO CATCH BASIN CLEANER
Is Serving Many States, Cities and Turnpikes Throughout This Broad Land

- Penn. Turnpike Comm.
- East Cleveland, Ohio
- Cumberland, Maryland
- Indianapolis, Ind.
- Lansing, Michigan
- Jersey City, N. J.
- Worcester, Mass.
- New York, N. Y.
- Boston, Mass.
- Chicago, Ill.

Easily mounted on any short wheel base truck with 8 ft. in back of the cab, the NETCO with orange peel or clamshell bucket can be operated continuously, averaging 20 to 30 catch basins a day. Hoisting capacity up to 1500 lbs.



NETCO does almost three times as many basins a day at less than half the cost per basin compared with old-fashioned manual methods.

Send for our 6-page descriptive folder

NETCO DIVISION
CLARK-WILCOX COMPANY
118 Western Avenue
Boston 34, Massachusetts

Econolite's new **Graphic Traffic Counter** provides a clear, accurate, continuous graphic record of traffic volumes. Long life and trouble free operation are obtained in this portable, lightweight counter by the use of dry cells.

SIGNIFICANT NEW TRAFFIC AIDS BY

ECONOLITE CORPORATION

Econolite's new **Die-Cast** Neon Pedestrian Signal with weather and corrosion resistant aluminum housing is attractive, lightweight and rugged. All components are safely and readily available from the front of the signal for simplified installation and service.

Econolite's new **Incandescent** Pedestrian Signal offers advanced mechanical design and improved legibility.

Write for further information.

ECONOLITE CORPORATION

Factory and General Offices

8900 BELLANCA AVENUE, LOS ANGELES 45

To order these helpful booklets check the reply card opposite page 34.

NEW LISTINGS (Cont.)

Clean Sewers With the O'Brien Sewerking

404. The O'Brien Sewerking operates completely by power in cleaning sewers and for full information write O'Brien Mfg. Corp., 5662 Northwest Highway, Chicago 30, Ill. Check the reply card to find out how power rotates cable and cutting tool and how power transmission drives cable forward or reverse.

Complete Line of Traffic Signals and Control Equipment

412. Econolite has acquired the General Electric line of traffic signals and control equipment and has available literature on types, models and specifications. Write Econolite, 8900 Bellanca Ave., Los Angeles 45, Calif.

3 and 4-cu. yd. Tractor Shovels With Torque Converter Drives

415. Operating, performance and maintenance advantages offered by the Allis-Chalmers HD-16G and HD-21G torque converter drive tractor shovels are described in 8-page catalog MS-1274, available from Allis-Chalmers Mfg. Co., Construction Machinery Div., Milwaukee, Wisc. Check the reply card for specifications.

Joint Compound for Sewer and Culvert Pipe

424. Data and specifications of cold applied Carey Sewertite asphalt base and tar base joint compound for sewer pipe, culvert and septic tank joints of concrete and vitrified clay are available. Check the reply card or write Philip Carey Mfg. Co., Lockland, Cincinnati 15, Ohio.

Selection of a Small Packaged Air Compressor

431. Catalog 1548 contains tabular and chart information on cu. ft. of air required to operate a variety of pneumatic equipment, average and continuous air supply tables and charts on ratios of compression and tables on flow of air through orifices. Check the reply card or write Ingersoll-Rand Co., News Service Dept., Phillipsburg, N. J.

Bay City CraneMobile Has Lifting Capacity of 40-ton

441. Bay City Shovels, Inc., 2611 Center Ave., Bay City, Mich., has available a 20-page, two-color catalog describing the CraneMobile for all types of construction.

A Guide to Nighttime Highway Safety

442. This 24-page Manual covers the needs for highway lighting, the need for legislation, where lighting should be installed, types of lighting, cost and how much light is needed. Copies are available from the Street and Highway Safety Lighting Bureau, 1400 Terminal Tower, Cleveland 13, Ohio, or check the reply card.

All-Purpose Plastic Finishes

444. Sav-Cote fluorescent is made of plastic resins that form a watertight, weatherproof skin that goes on by brush or spray gun over metal, fabric and wood. It can be used as color coding of pipe lines, traffic obstructions and safety markings and warnings of all types. Check the reply card or write Sav-Cote Laboratories, Belleville, N. J., for full details.

1960 Truck Line Story From Chevrolet

446. The 1960 Chevrolet truck line is described fully in literature from Chevrolet Motor Division, General Motors Corp., General Motors Building, Detroit 2, Michigan. Check the reply card for data on this line of 165 models.

Cut Snow Plowing Costs With Hydraulic Snow Plow Control

448. The Hydro-Clutch develops power to raise a snow plow blade completely in 6 secs. Check the reply card or write Gar Wood Industries, Inc., Wayne, Mich., for complete data on this Hydra-Clutch pump, cylinder and complete hydraulic system.

Engineering Data on Truck Mounted Snow Plows

449. Trip cutting edges, one-way plows, push frames and reversible snow plow moldboards are covered in literature from Flink Co., Streator, Ill.

WATER WORKS

Equipment For Water, Sewage and Industrial Waste Treatment

34. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

Wherever Water Flows, Steel Pipes It Best

26. Complete data on the use of steel pipe for water supplies are available from Steel Plate Fabricators Association, 105 West Madison St., Chicago 2, Ill. Check the reply card today.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Ball and Socket River Crossing Cast Iron Pipe

33. Literature is available describing Clow ball and socket cast iron pipe for river crossing, or any installation where full 15 degree free turning deflection is desirable. For description and specifications, address James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill.

Propeller Meters For Dependable Water Metering Control

53. The complete line of Measure-Rite propeller meters are described in Bulletin MR-105 available from Measure-Rite, Inc., 4545 W. Brown Deer Rd., Milwaukee 18, Wis. Check the card for details on these accurate meters.

the TARCO "Big Scottie"

a double-auger, all purpose non-bridging Body Spreader

The "Big Scottie" gives you these unique advantages: (1) the **double-auger spreading system** lets you apply more material per minute (salts, sand, cinders, or mixtures), (2) full-covering, heavy **top screen** is made in **4 hinged sections** so 1 man can handle, (3) the special **body design prevents** your **material** from **bridging** over the augers.

You'll be able to cover **more miles** of wintertime icy pavement **much faster.** The "Big Scottie" is an ideal spreader for spreading straight de-icing salts... you can apply as little as 3/4 of an ounce per square yard at **15 M.P.H.**

The "Big Scottie" slips in or out of a dump truck body in 15 minutes; or mounts on a truck chassis in less than 30 minutes. Besides the exclusive features of the double-auger spreading system and the non-bridging body design **(no agitator needed)**; the "Big Scottie" has all the regular features a good spreader should have: all welded steel construction; extra heavy, well protected roller chain drive (with **special lubrication system**); more than ample drive power **(30 H.P.)**; large, sealed bearings; simple, quick-acting width control; an easily read material application rate table for various materials at various truck speeds; stainless steel spreading disc.

See your nearest Tarco dealer or write us for more complete "Big Scottie" details.

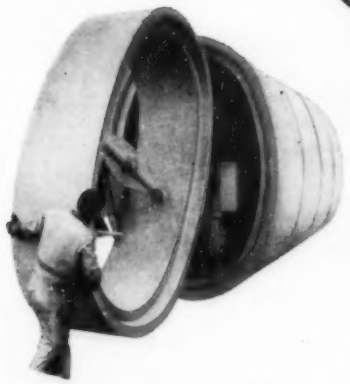
TARRANT MFG. CO.
28 Jumel Place, Saratoga Springs, N.Y.

No weather problems this winter —if you plan now...

PASS PIPE THROUGH PIPE UNDERGROUND

with Inner Circles

PRECAST REINFORCED CONCRETE TUNNEL PIPE



Worker guides an oval-shaped section of Inner Circles pipe which the Tunnelugger has carried through the conduit already laid.

Avoid the hampering effects of winter weather on outdoor construction by *working underground. Plan now* to utilize the Inner-Circles Method of building new sewers (left) and relining failing sewers (above) *this winter.*

Extensive surface excavation and back-fill eliminated • Reduced equipment and labor • Faster completion at *lower cost* • Overhead traffic undisturbed • Improved hydraulics • Pretested pipe strengths • Tight joints—even on sharp curves • Installation equipment furnished.

The two-way Tunnelugger can operate in either direction from a centrally operated shaft—quickly delivering and positioning elliptical sections through conduit already laid.

Inner Circles are the *most economical* method of installing tunnels in stable soils and on mild slopes. For more complete information write for an opinion by our experienced technical staff.

AMERICAN-MARIETTA COMPANY
CONCRETE PRODUCTS DIVISION
GENERAL OFFICES:
AMERICAN-MARIETTA BUILDING
101 EAST ONTARIO STREET, CHICAGO 11, ILLINOIS, PHONE: WHITEHALL 4-5600

To order these helpful booklets check the reply card opposite page 34.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Guide Book Information for Emergency Power

133. This book covers what to do when commercial power fails in a fire, flood, hurricane, war and other national disasters. Check the reply card or write Caterpillar Tractor Co., Engine Div., Peoria, Ill., for a copy of "The Four Horsemen of the Space Age."

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Engineering Data On Mechanical Joint C.I. Pipe

183. General specification, weights and dimensions of mechanical joint cast iron pipe and fittings are furnished in a 32-page booklet issued by Alabama Pipe Co., Anniston, Ala. Get this helpful data by checking reply card.

Lay Water Mains Faster With "Fluid-Tite" Couplings

184. Get permanent water-tight joints automatically with K & M "Fluid-Tite" couplings for K & M asbestos-cement pressure pipe. Full details on this faster installation and self-energizing couplings are available from Keasbey & Mattison Co., Ambler, Penna

Waterworks and Municipal Castings

293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

Bell and Spigot Joint Leaks Quickly Repaired

214. Broken water main can quickly be repaired when you have "Skinner-Seal" Split Coupling Clamps on hand. Leaky bell and spigot joints are made lastingly tight with Skinner-Seal Bell Joint Clamps. Get Skinner Catalog GW now—this handsome 48-page book shows how to make every type of pipe repair and covers a complete line of clamps to do the job quickly and easily. M. B. Skinner & Co., South Bend 21, Ind.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, and end suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., 636 Loucks St., Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-⅝"x¾"-¾" and 1". Check the reply card.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

Helpful Data on Swimming Pools

364. Data on injector nozzles for complete recirculation, fittings for correct drainage and other useful information for pool design are covered in Manual SP issued by Josam Mfg. Co., Michigan City, Ind.

Synchro-Start's new protective engine controls have been designed, for the starting and stopping of engines from remote pilot devices, such as pressure switches, float switches, power failure relays, etc., and are completely automatic in operation. These dependable controls are encased in a steel, dust proof cabinet, and now feature enclosed PLUG-IN RELAYS as well as OVERLOAD BREAKERS. The plug-in relays simplify what little field maintenance that may have been required in older models, while the overload breakers eliminate the necessity of replacing fuses.

In designing this unit we have used the same high quality materials and workmanship that our customers have come to expect throughout Synchro-Start's 27 years of manufacturing engine controls.

SYNCHRO-START PRODUCTS, INC.
8151 N. RIDGEWAY AVE. • SKOKIE, ILLINOIS

COST SAVING TRUCK CRANE for UTILITIES AGENCIES and GOVERNMENT

the HIAB 170

one man operated — fully hydraulic

Here's a LOW COST, versatile, fully hydraulic, one-man operated truck crane that's an ideal tool for utilities and government agencies. Write for the names of current users. The HIAB 170 offers a range of lifting capacities from 6,000 lbs. on the shortened boom of 5' to 2500 lbs. on a full boom of 13'. The boom length is easily adjustable through hydraulic control.

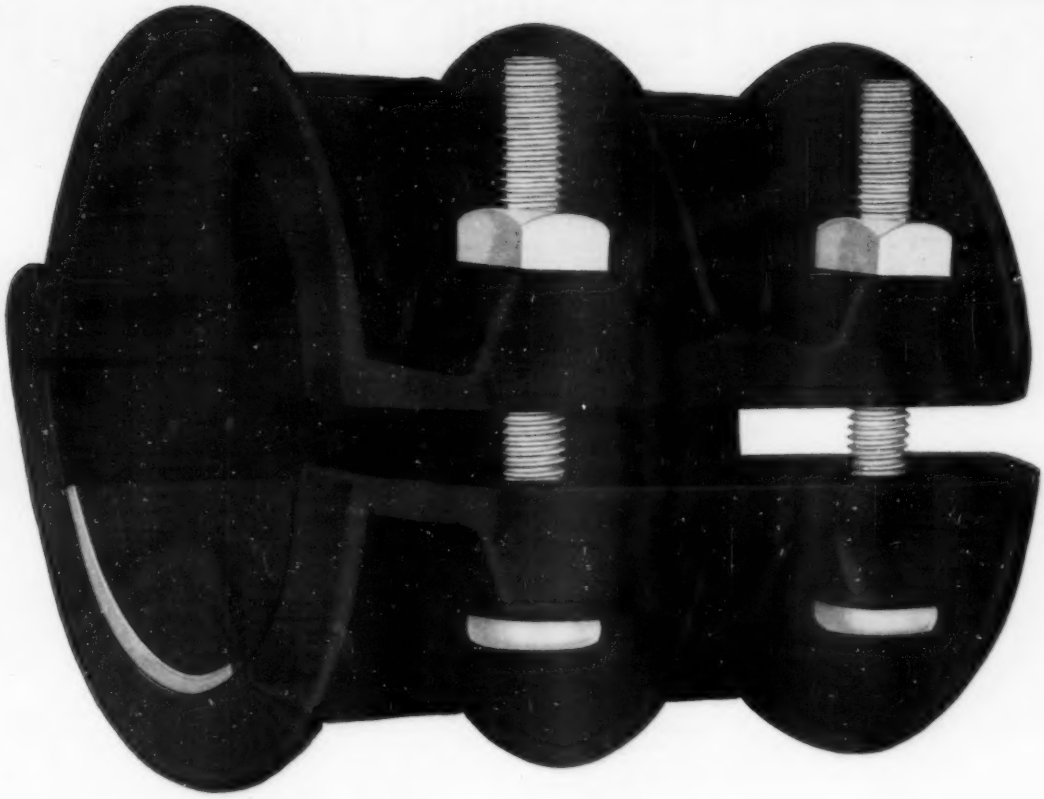
An efficient general utility tool for maintenance work, the HIAB 170 will lift up to 20' above ground level at a maximum speed of 20" per second. Control is from either side of the truck cab. Crane action is positive and accurate. 200° or 360° swing arc. When not in use the HIAB 170 folds snugly behind the cab, taking only 15" of space. This leaves the entire truck bed open for load. Also available is the HIAB "Bimbo" Model 290—a smaller version of the HIAB 170, with the same design features.

San Diego Gas & Electric Company finds the HIAB 170 a time-saving tool.

Write for name of nearest dealer

Stanco MFGS. & SALES INC.
1666 Ninth St. (Corner of Olympic & Ninth)
Santa Monica, California

Stanco MIDWEST SALES INC.
P. O. BOX 787
Chicago 42, Illinois



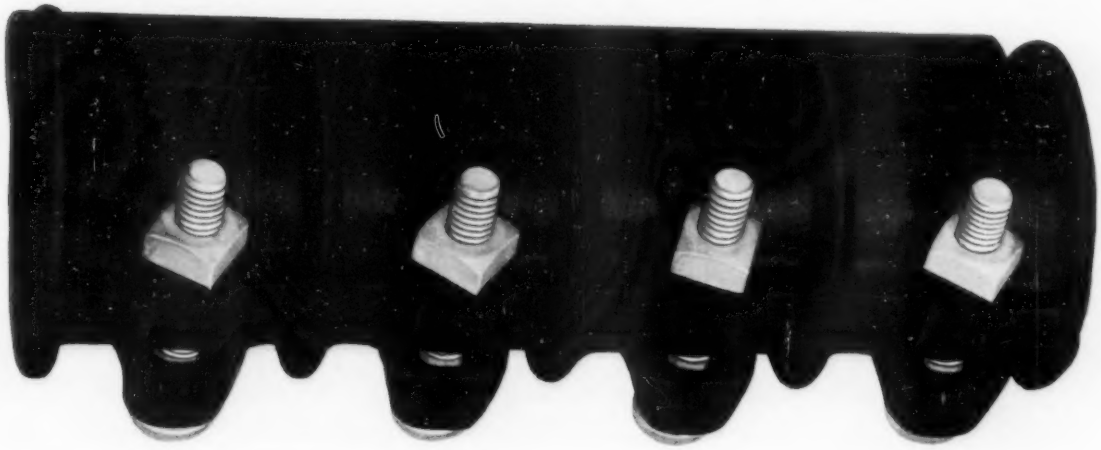
EMERGENCY PIPE CLAMP

SKINNER-SEAL

PIPE LINE CLAMP

For repairing corrosion leaks and splits in pipe lines and water mains! Its action is definite and final. Massive construction — tremendous margin of safety on highest water pressures. Sizes ½" to 12" inclusive for steel and also cast iron pipe. Write for folder.

M. B. SKINNER COMPANY
SOUTH BEND 21, INDIANA, U. S. A.



To order these helpful booklets check the reply card opposite page 34.

Outline of Modern
Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

Renew Pipe Performance
With Cement Mortar Lining

322. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.

Book Tells
How to Control Algae

371. Details on the control of various microscopic organisms frequently found in water supplies are furnished in a 44-page booklet offered by Phelps Dodge Refining Co., 300 Park Ave., New York 22, N. Y. Check the reply card.

Modern, Welded Constructed
Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals.

Submersible Pumps
for Municipal Water Supply

478. Submersible pumps from 3 through 125 hp in speeds of 3550 and 1750 rpm are described and illustrated in Bulletin B1200 available from Sumo Pumps, Inc., 23 Brown House Road, Stamford, Conn.

Tips for Installing
Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included.

U. S. Tyton
Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co. Birmingham 2, Ala., or check the reply card

Residual Chlorine Recorders For
Water Plants and Swimming Pools

508. An instrument for measuring residual chlorine amperometrically in a continuous sample and recording the reading in parts per million on a 24 hour circular chart is described fully in literature available from Wallace & Tiernan Inc., Box 178, Newark, N. J.

Standardized Motor
Control Centers

581. The Unitrol is designed to meet your specific control requirements by providing full open phase protection with 3-coil overload relays and other features. Check the reply card or write Cutler-Hammer, Inc., Milwaukee 2, Wisc.

Automatic Torque Controlled
Constant Viscosity Lime Shakers

582. Viscomatic shaker shakes lime as a paste with cold water and provides maximum hydrate availability. Check the reply card or write Infilco Inc., Tucson, Ariz., for details on this lime shaker and its utilization in water and waste applications.

Helpful Data on
Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Parshall
Measuring Flumes

498. Measure water accurately with all-steel Parshall measuring flume. Free-flow discharge tables, formulas, weights, capacities and dimensions are covered in Catalog B-31-C available from Thompson Pipe & Steel Co., 3025 Larimer St., Denver 1, Colo.

Manual on Valves,
Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Diatomite Filters
in Water Filtration

596. A new line of IWF diatomite filters is featured in this 10-page Bulletin 651 by the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. The IWF is ideal for medium and small town water supplies and the bulletin provides installation drawings, sectional views and operational sketches.

AWWA Butterfly Valves
Custom Built to Specifications

630. Butterfly valves that can be operated by air, oil, water, electrically or manually and are made in standard sizes to 24 ins. are fully described in literature from Fabri-Valve Co. of America, P. O. Box 4352, Portland 8, Ore.

BAUGHMAN SAND and CINDER SPREADER

SAFETY CHAMPION FOR STREETS AND HIGHWAYS
choice of 4 drives

PTO with { Mechanical Operation / Hydraulic Operation }

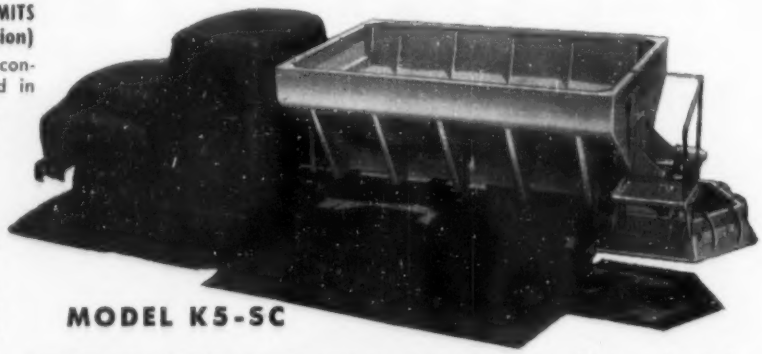
Auxiliary Engine with { Mechanical Operation / Hydraulic Operation }

CAB CONTROLLED VACUUM CLUTCH PERMITS SPOT SPREADING (on mechanical operation)

Completely sealed, vacuum operation, controlled from cab. Start or stop spread in motion, as at intersections, safety zones. On hydraulic operation models, spot spreading is controlled by by-pass valve.

TWO-SPEED "QUICK CHANGE" MECHANISM

Simple sprocket and chain drive: low for chemical spreading, high for large-volume spreading. No need for expensive automotive transmission. On hydraulic opetation models, spreading volume is valve controlled.



MODEL K5-SC

Better service through better engineering

WRITE FOR NEW ICE CONTROL CATALOG!

Service and parts from 200 service branches

BAUGHMAN

BAUGHMAN MANUFACTURING COMPANY

223 SHIPMAN ROAD

JERSEYVILLE, ILL.

BRUSH DISPOSAL CREWS OPERATE FULL TIME WITH THE TROUBLE-FREE FITCHBURG CHIPPER

CITY

This low-maintenance Fitchburg Chipper is disposing of brush in the City of Holland, Michigan.

UTILITY

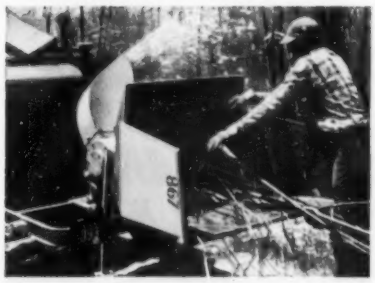
"Our men have been particularly pleased with their Fitchburg Chippers . . . they are rugged and reliable."

Rockland Light & Power Company
Nyack, New York

TREE COMPANY

"We have never had one (Fitchburg Chipper) wear out or give excessive trouble." Chipper still operating after 9 years.

Davey Tree Surgery Co. Ltd.
San Francisco, Calif.



PUBLIC WORKS DEPT.

"Our Fitchburg Chipper consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower."

Dept. of Public Works
State of Rhode Island

When crews go out to trim trees, it's costly to have machine breakdown. That's why foresters, park superintendents, line clearing supervisors, and tree companies prefer the Fitchburg Chipper. This well-engineered brush chipper is designed for busy, trouble-free service, no down-time.

The rugged Fitchburg Chipper requires little upkeep, and has low maintenance cost. It's economical to operate. And crews like the exclusive spring-activated feed plate which adjusts itself automatically to any size brush up to its rated capacity. This patented feed-plate provides protection from damage from foreign materials, makes for greater crew safety.

The Fitchburg Chipper is engineered to work fast, safely, and to be always "ready to go." It's the chipper which won't slow down your crews, lets you plan their work intelligently—saves you time and money.

Please send in the coupon for more information, and for copies of articles on chipping which appeared recently in leading publications. These feature articles describe five methods of brush disposal and ten new ways to utilize "by-product" chips. Send for your copies, they are well worthwhile.

FITCHBURG ENGINEERING CORPORATION
Dept. PW-109, Fitchburg, Massachusetts

☐ Please send me important articles which describe 5 methods of brush disposal, and 10 new ways to utilize brush chips.

☐ Please send more information on Fitchburg Chippers.

Name_____

Address_____

City_____ Zone____ State_____

FITCHBURG ENGINEERING CORPORATION FITCHBURG, MASS.

To order these helpful booklets check the reply card opposite page 34.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Expansion Joints Used In Concrete Construction

680. Asphalt, fibre, corkfill and sponge rubber expansion joints are covered in catalog on Sealtight joints and other top-quality Sealtight products available from W. R. Meadows, Inc., 25 Kimball St., Elgin, Ill. Check the reply card for data on how these expansion joints are used in pavements, runways, bridges, ramps and other concrete structures.

Bulletin Covers Step-by-Step Action on the Water Problem

689. A step-by-step outline of action telling how the responsible citizens can help their officials extend and improve the local water system through more adequate rate structures on financing is covered in this bulletin available from Thos. F. Wolfe, Managing Director, Cast Iron Pipe Research Association, 3440 Prudential Plaza, Chicago 1, Illinois.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Mueller Drilling, Tapping and Inserting Machine

696. The Mueller B-100 double pressure chamber tapping machine makes faster taps, assures pressure tight connections and can be used by hand or with power. Check the reply card or write Mueller Co., Decatur, Ill.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Entirely New Small Sewage Treatment Plant

40. The Sparjair units are package type plants that range in size from a 50 population equivalent to 5000 and utilize the contact stabilization process to produce a clear, nuisance free effluent. Copies of Bulletin 22-S-94 are available from Walker Process, P. O. Box 266, Aurora, Ill., or check the reply card.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Stationary Engines For Sewage and Water Treatment Plants

82. Engines that operate on sewage gas, gasoline, butane or natural gas are described in literature from Climax Engine Mfg. Co., Div. of Waukesha Motor Co., Clinton, Iowa. Check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

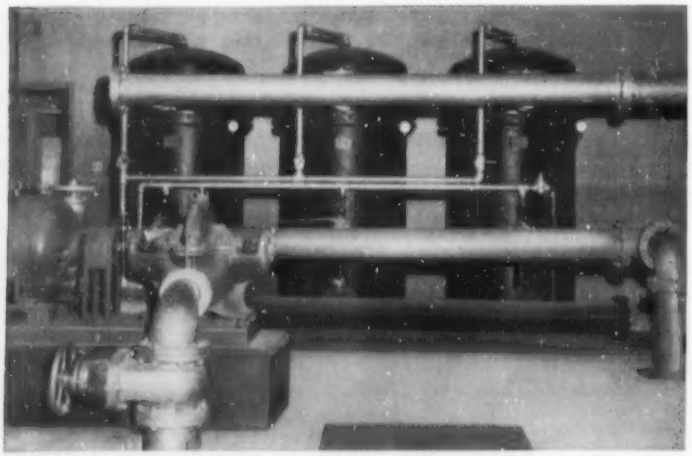
Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Separators and Thickeners for Water, Sewage and Waste Treatment

275. Photos and diagrams are used extensively in Bulletin 315-101 to illustrate the design features, the types of tanks used and the operating principles of Float-Treat separators and thickeners. Check the reply card or write Chain Belt Co., Dept. P. R., Milwaukee 1, Wisc., today.

ADAMS DIATOMITE FILTERS ARE *BEST...*



Shown above is a typical Adams filter installation handling the entire water supply of a small eastern community. The three units are capable of handling more than 1500 gpm. with plenty of spare capacity for peak periods.

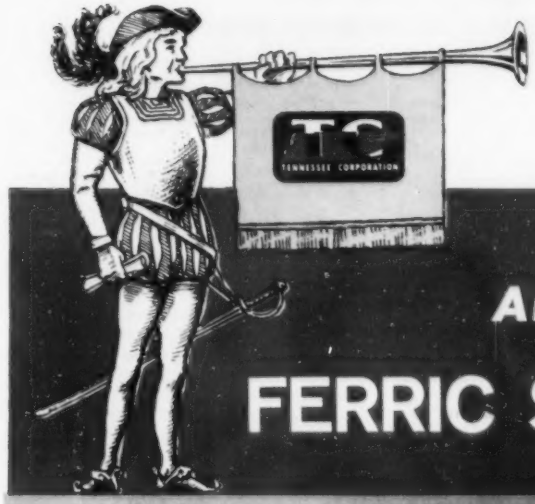
for Small Community Water Systems

Maximum filter efficiency and capacity, coupled with minimum space requirements, enable the Adams line of diatomaceous earth filters to more effectively solve small community water filtration problems. Diatomite filtration assures you a water supply of sparkling clarity...the year 'round.

Exclusive Adams Hydro-Pneumatic backwashing simplifies operation — for more complete and rapid backwash and reduced labor requirements. The Adams filter systems are compact — do not require extensive ground area, elaborate foundations and other expensive construction features.

Why not investigate how an Adams system can improve your water supply. Write today—

R. P. ADAMS CO., Inc. • 228 East Park Drive, Buffalo 17, N. Y.



Announcing a New

FERRIC SULFATE PLANT

These new facilities now in operation at Copperhill, Tennessee substantially increase our production of Ferri-Floc and will permit us to supply the increased demands for this superior coagulant at all times.

THE COAGULANT WITH THE PLUS FEATURES

ferri-floc
TC
FERRIC SULFATE

Excellent Taste and Odor Control
Increased Filter runs
Coagulation over Wide pH range
Rapid Floc Formation
Turbidity Removal
Manganese and Silical Removal
Bacteria Removal
Ease of Operation
Efficient and Economical

AVAILABLE IN BULK, AND ALSO IN DOUBLE LINED POLYETHYLENE BAGS AT NO EXTRA COST.

FREE BOOKLET — We will send you, without charge, a 38 page booklet that deals specifically with all phases of coagulation —Just make request on your firm's letterhead.

TC
TENNESSEE CORPORATION

TENNESSEE CORPORATION
615-629 Grant Building, Atlanta 3, Georgia

To order these helpful booklets check the reply card opposite page 34.

Incinerators for the Disposal of Combustible Wastes

217. Bulletin 179 from the Morse Boulger Inc., New York 17, N. Y. describes fully the basic principles of incineration as to combustion, auxiliary burners, draft and control and elimination of fly ash. Specifications and design of incinerators and hopper doors are included.

Fibre Pipe For Sewer Lines and Septic Tank Connections

232. Bermico bituminized fibre pipe is lightweight, rootproof and easy-to-install. Check the reply card or write Brown Co., 150 Causeway St., Boston 14 Mass., for full details.

Turnkey Sewage Treatment Plant

239. Plants for smaller population areas that are furnished and installed on a turnkey basis are covered in literature from Municipal Service Company, 4625 Roanoke Parkway, Kansas city 12, Missouri. Check the reply card for your key to low cost sewage treatment.

Governors and Speed Switches

340. New style governors and speed switches which have a variety of applications are covered in bulletins from Synchro-Start Products, Inc, 8151 No. Ridgeway Ave., Skokie, Ill. Check the reply card for prices and specifications.

Data and Specifications on Aluminum Grating Walkways

531. Aluminum walkways for bridges, sewage and water treatment plants and garages are covered in bulletins available from Washington Aluminum Co., Inc., Knecht Ave. & Pennsylvania R. R., Baltimore 29, Md.

Small Unit Sewage Treatment For 20 to 5000 People

568. Bulletin 135A describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

Water, Sewage and Industrial Waste Treatment Equipment

339. This 20-page Bulletin 2617 presents Link-Belt Company's complete sanitary engineering equipment line. Check the reply card or write Link-Belt Co., Dept. PR, Prudential Plaza, Chicago 1, Ill., for data on how this equipment works.

Descriptive and Performance Data on Sump and Sewage Pumps

351. Performance tables, selection charts, characteristic curves and architect's and engineer's specifications of Pacific sump and sewage pumps are included in complete catalog from Pacific Pumping Co., 9201 San Leandro St., Oakland 3, Calif., or by checking the reply card.

Improved Method for Supplying Activated Sludge Process Demands

356. Bulletin No. 7316 describes the development, design and advantages of this improved method for supplying oxygen demands in the activated sludge process. Check the reply card or write Dorr-Oliver Inc., Stamford, Conn., for cutaway wash drawings of typical aerator installations and an activated sludge flowsheet.

Remote Supervisory Pump Operation

405. Bulletin RTM describes remote supervisory pump operation by using telephone lines for communication circuits. Write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check the reply card for data on this unit for water and sewage works.

Chemical to Control Landfill Odors

501. Cloroben Landfill and Refuse Spray applied to landfill areas in 1 to 5% dilutions prevents and eliminates obnoxious odors. Mosquito and fly larvae are exterminated. Spraying or flushing of garbage trucks with 1% dilution of CL&R Spray will provide effective odor and insect control in these vehicles. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearny, N.J.

Separation of Suspended Solids in Water and Sewage Treatment

512. A 24-page bulletin covering the complete line of clarifier and Oxidator[R] mechanisms is available from Process Engineers, Inc., 420 Peninsular Ave., San Mateo, Calif. Check the reply card for the basic types that cover a full range of tank sizes and load requirements, and special units for unusual conditions.

Catalog on Multiple Pressure Readout System

544. A 12-page, 2-color, Catalog 30B1000 describes F & P multiple pressure readout system which measures and records hundreds of different pressures simultaneously using a single high accuracy transducer. Check the reply card or write Fischer & Porter Co., 225 Jacksonville Rd., Hatboro, Pa.

Specifications on Trash-Sewage Pumps

599. Complete specifications, drawings, performance curves and the applications of Gorman-Rupp trash-sewage pumps are covered in literature from The Gorman-Rupp Co., Mansfield, Ohio. Check the reply card.

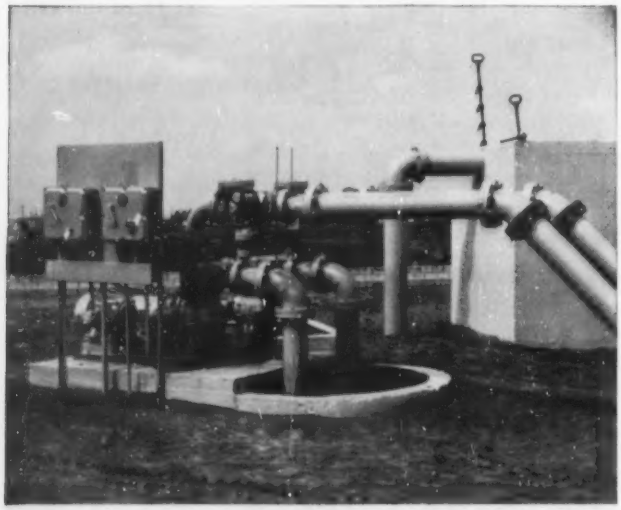
Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 1786 Durango Ave., Los Angeles 34, Calif.

HIGH and DRY...not way down in the pit...GORMAN-RUPP SEWAGE PUMPS



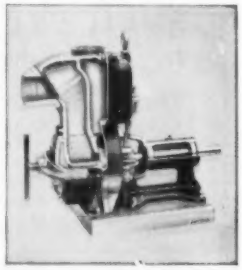
Twin installation of Model 14A2-B at a sewage treatment plant, Clair-Mel City, Tampa, Fla. Controls alternate pumps at regular intervals.

COST LESS TO BUY—Self-priming in lifts up to 15′, positive in action, nearly completely non-clogging. High and dry, their installed cost has allowed savings of as much as 50%.

COST LESS TO MAINTAIN—Almost no maintenance needed! No need to service by entering pit or raising pump. Just a turn of the wrist and the end plate is off.

PERFORM WHERE OTHERS FAIL—In lift stations and sewage plants, these Gorman-Rupp units have shown amazing records of savings . . . operating where others have failed. Let us show you examples.

2″, 3″, 4″ and 6″ pumps—connected to your power or ordered complete with power units. Write for complete specifications.



FAST-ACTION END PLATE—Exclusive end plate releases for access to impeller and wear plate. Two-vane open impeller specifically designed for handling spherical solids.

THE GORMAN-RUPP COMPANY

305 Bowman Street • Mansfield, Ohio

To order these helpful booklets check the reply card opposite page 34.

STREETS AND HIGHWAYS

Modern Compaction Methods and Equipment

200. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn., for your copy.

Reinforced Concrete Cribbing for Highways and Embankments

267. Typical wall sections and details of standard units of open or closed face concrete cribbing are covered in catalog from American-Marietta Co., Concrete Products Div., American-Marietta Bldg., 101 East Ontario St., Chicago 11, Ill. Check the reply card for general specifications and installation of the cribbing.

Manual on Steel and Wire for Road Building

337. Design data on wire fabric for concrete pavements, joint data, guardrail design standards, steel and wire for concrete pipe and reinforced bituminous concrete design are some of the sections covered. Check the reply card or write American Steel & Wire Div. of United States Steel Corp., Cleveland 13, Ohio, for this valuable manual.

Ultra-Clean Sweeping For Streets, Yards and Airports

499. A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

Data on Portable Hydraulic Earth Borer

138. Complete specifications on the Holan hydraulic earth borer are available from J. H. Holan Corp., 4100 West 150th St., Cleveland 11, Ohio. Check the reply card for literature.

Davis Backhoe Has Hydra-Slide Positioning

189. It is possible for one man to move the entire digging assembly along the frame to any of the five positions in less than five minutes. Full details from Massey-Ferguson Industrial Div., 1009 South West St., Wichita, Kans. Check the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass

How To Build Stabilized Heavy Traffic Pavements

300. A 16-page booklet published by Seaman-Andwall Corp., 13050 West Blue Mound Rd., Elm Grove, Wisc. shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worthwhile booklet for every highway engineer.

Pavement Sealer Protects and Preserves Asphalt Pavement

450. Parking lots, airfield runways, driveways and playground areas are places where Koppers pavement sealer can be used. Check the reply card or write Koppers Co., Inc., Tar Products Div., Pittsburgh 19, Pa., for data on this easy to apply sealer.

The Trucks You Need for Every Public Works Job

461. Extra life and operating economies are built-in features of every Ford truck model. There's a chassis size and engine for each of your needs, from light utility work to heavy-duty construction jobs. Get latest literature from Ford Motor Co., Truck Div., Dearborn, Mich., by checking the reply card.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Sweeping Brushes for Road and Sanitation Departments

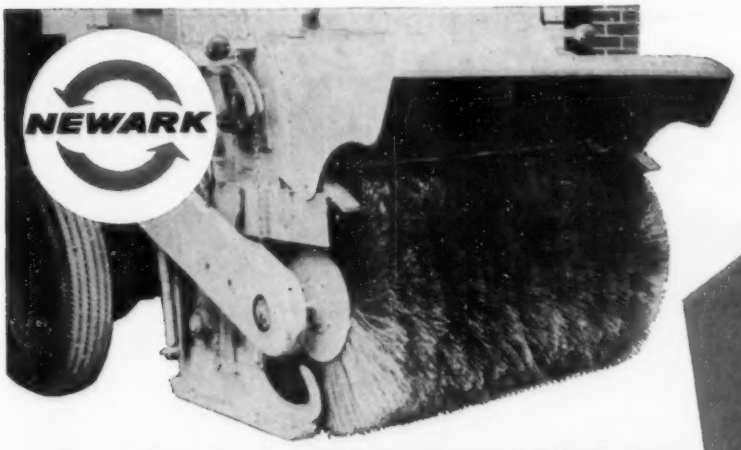
648. Danline brushes made of round brush wire are easily assembled and require a minimum amount of repair and maintenance. Check the reply card or write Newark Brush Co., 260 Michigan Ave., Kenilworth, N. J., for full details.

Manual on Highway Railings For Bridges and Roadways

660. This manual covers design suggestions, components, specifications for design and construction and the advantages of Alcoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable manual.

Transit Cranes for Bridge and Highway Building

691. Transit cranes that can lift 33,000 lbs. at 20-ft. radius, and 13,000 lbs. at 40-ft. radius with 60-ft. boom and outriggers set are described in literature from Bucyrus-Erie Co., South Milwaukee, Wisconsin. Also featured are load control, folding boom and boom lengths.



Here's why! . . . New, round brush wire, permanently locked in place and uniformally distributed by Danline's unique construction, produces the wearing and sweeping qualities you are looking for . . . In addition to longer life, you can remove up to 10" of sand in a single pass — even handle heavy loads of dirt, snow, gravel, etc. . . . Danline has been test-proven over countless thousands of sweeping miles by hundreds of municipalities . . . Write or call for complete, illustrated brochure, then watch your Danline and see for yourself!

Newark Brush Company.

59-1

260 MICHIGAN AVENUE
KENILWORTH, NEW JERSEY

One DANLINE Outwears 15 Fibre Brooms*

*U.S. Pat. 2864112

To order these helpful booklets check the reply card opposite page 34.

CONSTRUCTION EQUIPMENT AND MATERIALS

What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Catalog on Utility Bodies and Equipment

360. General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N Broadway, St. Louis 15, Mo.

Restoration and Protection Of Concrete Structures

385. A "How to Do It" bulletin describing the Thoro System for repair and sealing interior and exterior masonry surfaces is available from Standard Dry Wall Products, Inc., New Eagle, Pa. The treatment for every water problem is presented in illustrated case histories in this useful publication.

Modern Economical Tractors and Tractor Units

231. Up-front operator position, Quadra-torque operation and greater ground clearance are some of the features of the new Eimco tractors. Check the reply card or write The Eimco Corp., Tractor Loader Div., 634 South 4th West, Salt Lake City, Utah, for your literature.

From a Stump to Chips in Minutes

303. Pow-R-Stump cutter is operated by one man, handles stumps of any width and up to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

Allis-Chalmers Crawler Tractors and Motor Scrapers

306. Two catalogs offered by the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wisc., give engineering features and operating advantages of the TS-260 motor scraper and the HD-6 diesel powered crawler tractor. Check the reply card for specifications.

One Man Operated—Fully Hydraulic Truck Crane

459. Boom length which is hydraulically controlled extends to 13 ft. and can lift up to 6,000 lbs. Check the reply card or write Stanco Mfgs. & Sales Inc., 1666 Ninth St., Santa Monica, Calif., for complete data.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Manual on Structural Shapes

479. This 80-page catalog has a wealth of information, engineering data, and tables for engineers, architects and designers of steel buildings and other steel structures. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for your copy.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.

Manual on Construction Castings

462. This 168-page Manual covers catch basin inlets and traps, building castings, manhole covers and steps, flap valves, wheel guards, drainage grates and many other construction and maintenance castings. Check the reply card or write Neenah Foundry Co., Neenah, Wisc., for your copy.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

Slide Rule PSI Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

(More listings on page 52)

15,000 Patterns

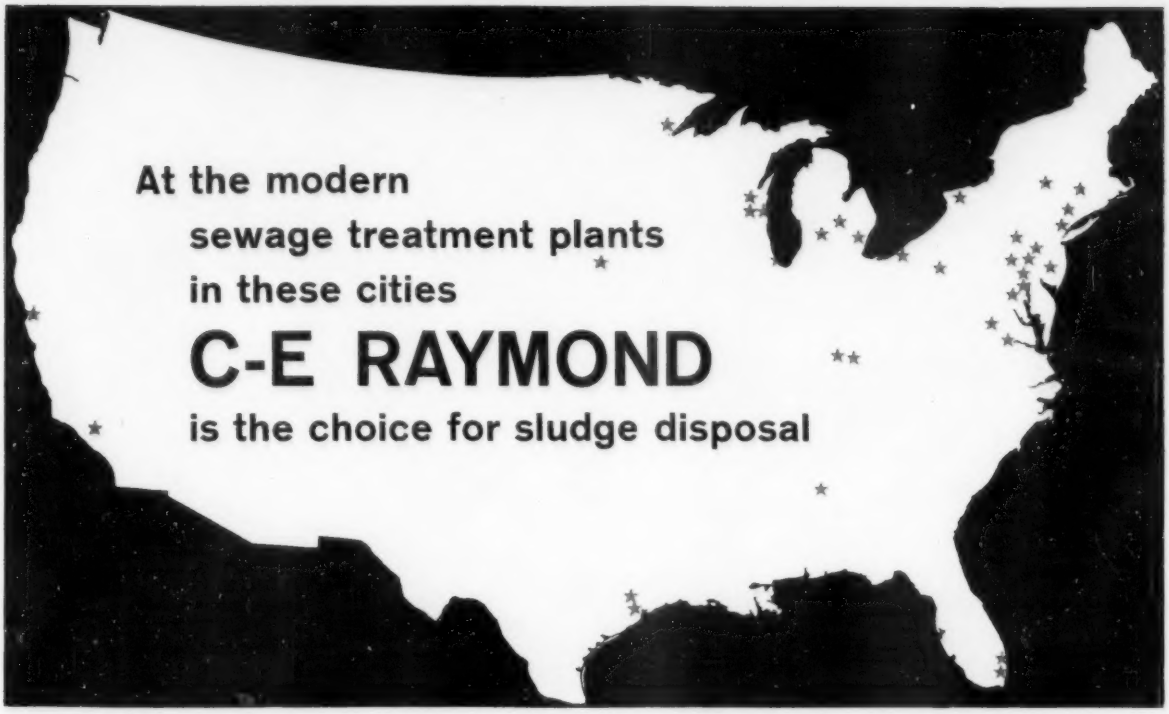
ON HAND FOR GRAY AND DUCTILE IRON

Construction Castings

WITH LARGE STOCKS MAINTAINED FOR PROMPT SHIPMENT ANYWHERE

NF NEENAH FOUNDRY COMPANY • NEENAH • WISCONSIN

Send for free 168-page catalog • Chicago Office: 5445 North Neva Avenue, Chicago 31, Illinois



Here are some reasons why the C-E Raymond Flash Drying and Incineration System has been selected by treatment plants throughout the country . . .

Flexible – It reduces filter cake to non-lumpy particles of uniform low moisture content without scorching . . . a product very suitable for use as soil conditioner . . . or if sludge characteristics render it unfit for this use, quickly incinerates it to a sterile ash. It is available with high temperature deodorization and fly ash collection.

Efficient – It assures built-in plus-performance for effective and controlled drying of filter cake with high *thermal* efficiency. This means less fuel cost penalty when incinerating low heat-content sludges since design thermal efficiency can be consistently maintained.

Advanced – It incorporates small groups of arch bricks individually hung from steel supports rather than relying upon self-supporting refractory arches. This requires little maintenance, makes arch failure virtually impossible, and permits rapid start-ups . . . less than 30 minutes for furnaces capable of burning in excess of 120 tons of filter cake daily. It has the most fully automatic controls for drying and furnace operation of any system available.

Proven – It is the most widely used method for heat disposal of sewage sludge. More filter cake is dried and/or incinerated in the C-E Raymond System than in all other systems combined.

For further details contact the Combustion Engineering office nearest you. Our engineers will be happy to discuss, with you or your consultants, how this system can benefit your community.

★ **Communities in the United States which have selected C-E Raymond for sewage sludge disposal**

Baltimore, Md.
Battle Creek, Mich.
Bethlehem, Pa.
Bloomsburg, Pa.
Buffalo, N. Y.
Camden, N. J.
Chicago, Ill.
Coral Gables, Fla.
Cuyahoga Falls, Ohio
Duluth, Minn.
Fond du Lac, Wisc.
Galveston, Texas
Harrisburg, Pa.
Houston, Texas
Jefferson Co., Ala.
Lansing, Mich.
Los Angeles, Calif.
Louisville, Ky.
Lynchburg, Va.
Miami, Fla.
Neenah-Menasha, Wisc.
New Albany, Ind.
New Rochelle, N. Y.
Omaha, Neb.
Petersburg, Va.
Pittsburgh, Pa.
San Francisco, Calif.
Schenectady, N. Y.
Sheboygan, Wisc.
Springfield, Mass.
Warren, Mich.
Washington, D. C.
Waterbury, Conn.
Wyomissing Valley, Pa.
York, Pa.

COMBUSTION ENGINEERING

RAYMOND DIVISION

C-E

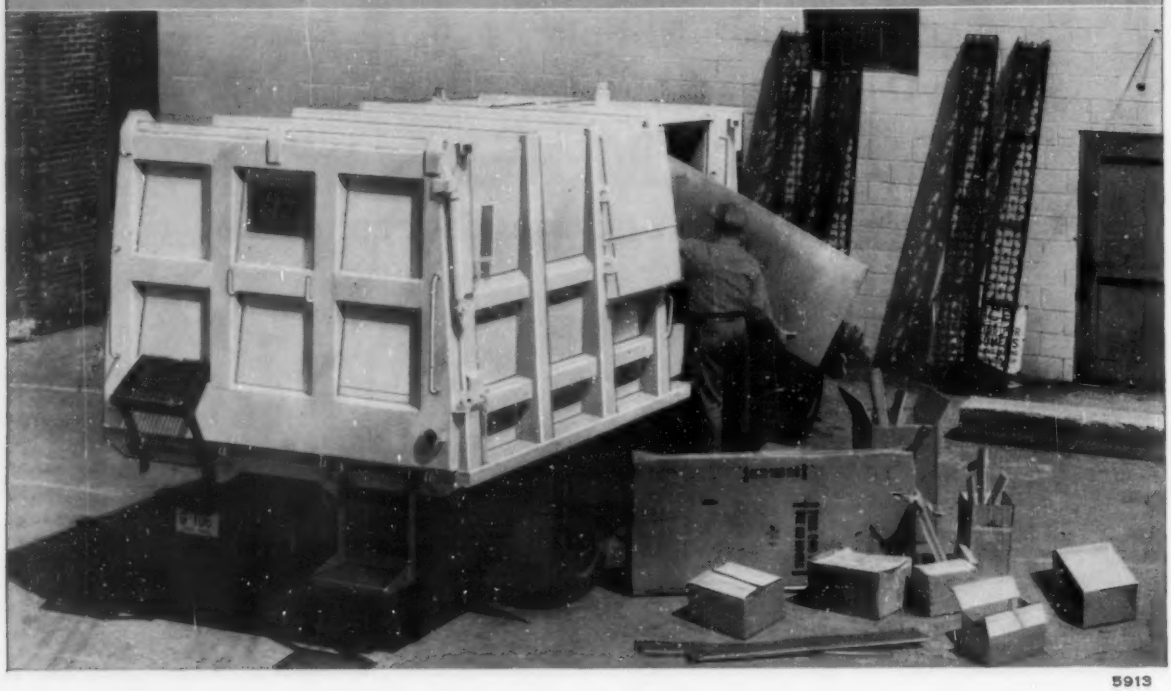
C-211

1132 West Blackhawk Street, Chicago 22, Illinois

Eastern Office: 200 Madison Avenue, New York 16, N. Y. • Western Office: 510 West Sixth Street, Los Angeles 14, Calif.

Canada: Combustion Engineering-Superheater Ltd.

ALSO FLASH DRYING AND INCINERATION FOR INDUSTRIAL WASTE DISPOSAL



5913

ONE HYDRO E-Z PACK can do the jobs you're using three trucks to do!

Just one Hydro E-Z Pack unit is enough to pick up residential and commercial garbage and trash. Garbage, tree limbs, cartons, crates and "you-name-it" are tightly compacted in one load by the Big Squeeze Bulldozer. This compaction makes every load a "baled" load. E-Z Pack can eliminate three or more open trucks or ordinary packers. Make more routes in less time, fewer trips to the dump, and use less labor all around. Means lower costs for cities, more profit for contractors.

Prove it! Ask for a demonstration of Hydro E-Z Pack right on your route, or write for free copy of "The Big Squeeze."

COMMERCIAL—No need to break down large cartons or crates; E-Z Pack takes 'em as is!

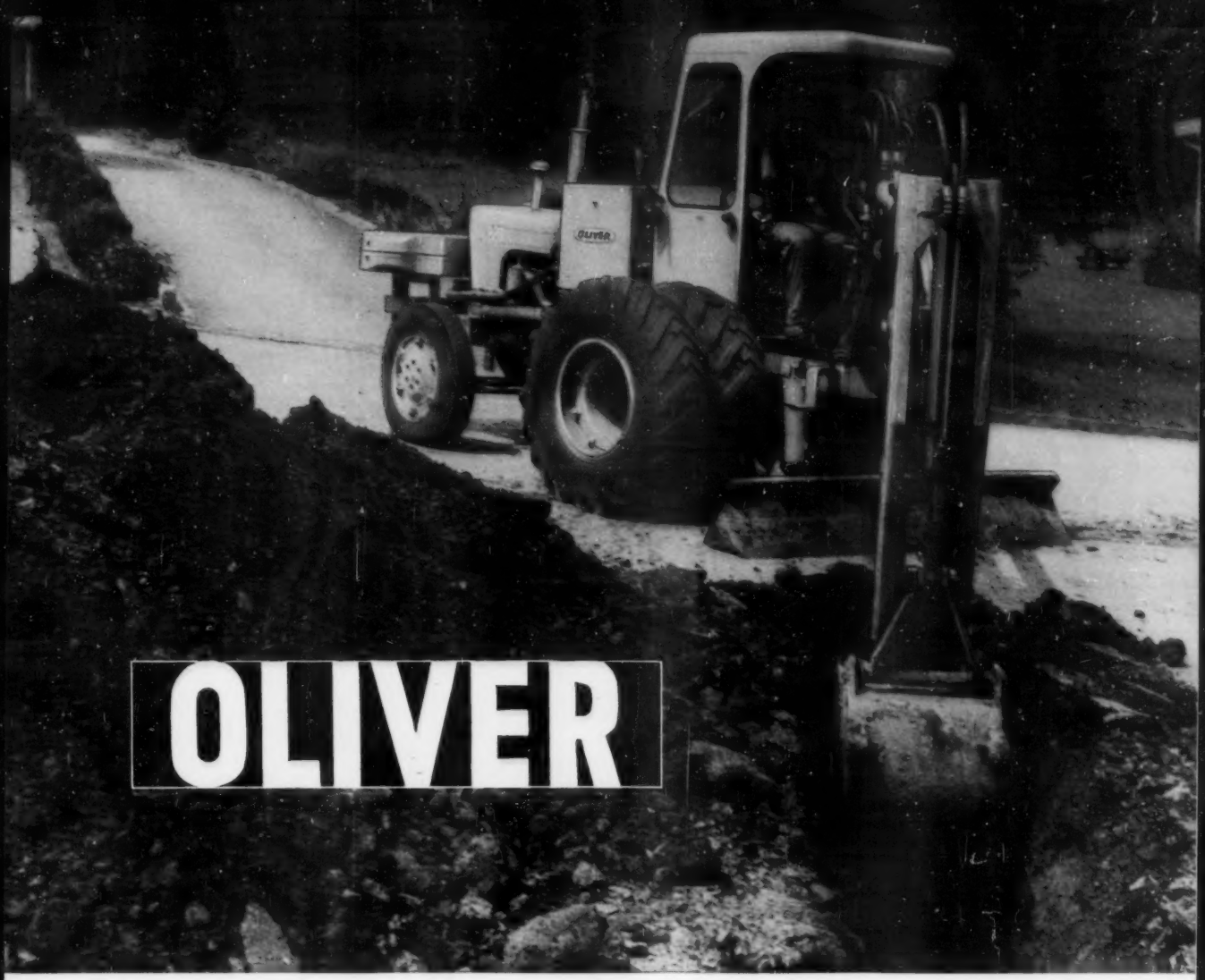
YARD TRASH—Tree limbs and trash are all compacted by 76,000 lbs. pressure in one load!

RESIDENTIAL—Garbage, ashes, junk, tree limbs, leaves, cartons, trash; E-Z Pack takes everything!

Hydro E-Z PACK

HYDRO E-Z PACK®

HYDRO E-Z PACK—DIVISION OF HERCULES GALION PRODUCTS, INC., GALION, OHIO — U.S.A.



30% MORE PRODUCTION DIGGING IN ROCK WITH OLIVER 80-HT

LOAD TO THE LIMIT with the 1-yd. Oliver 888. Get easy, instantaneous 1-lever forward-reverse cycling with Oliver "Reverse-O-Torc." Heavy-duty industrial torque converter with fluid coupling *automatically* matches power to the load... ends foot clutching. You can travel anywhere at speeds up to 17 m.p.h. Be sure to load-test this mighty producer!

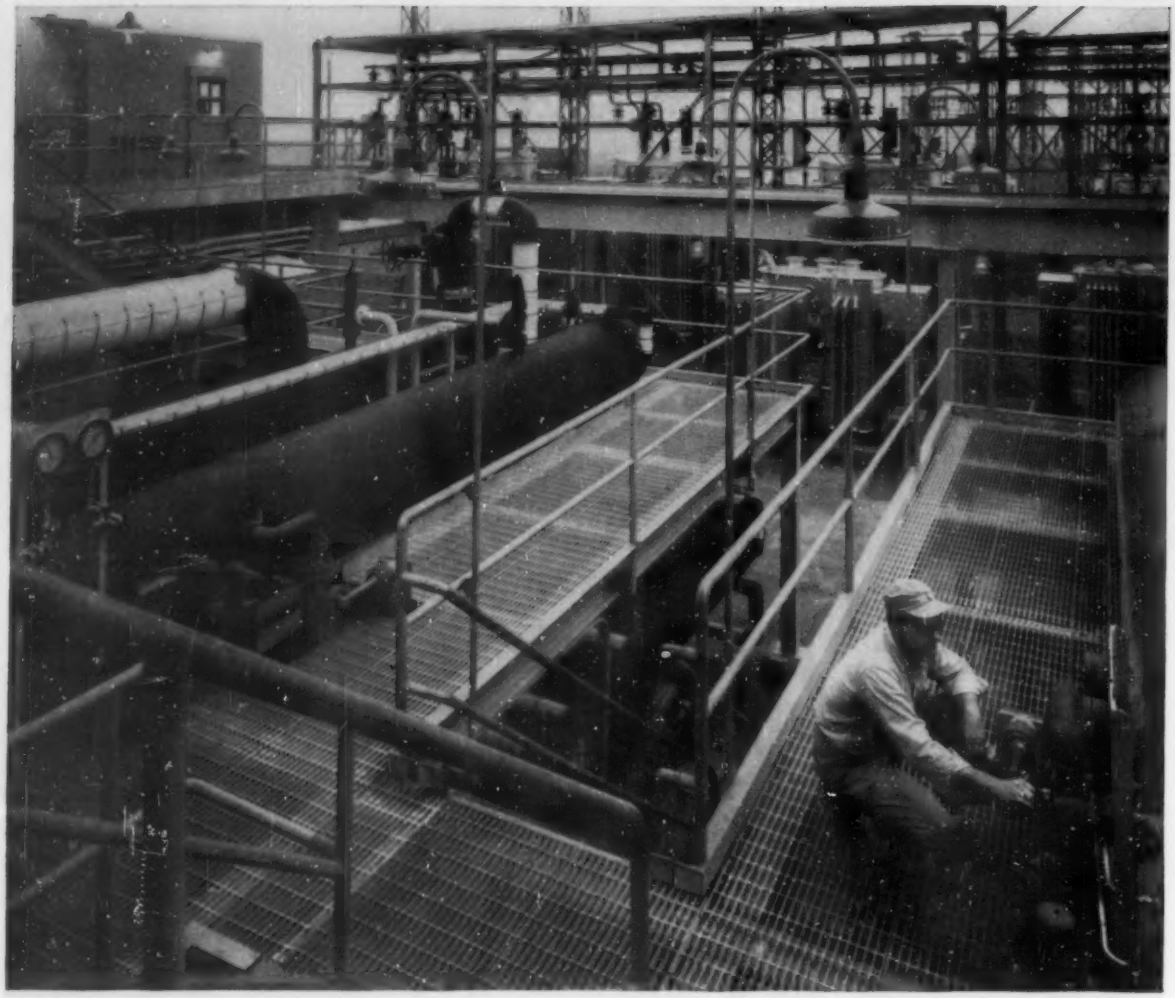
Digging laterals for 250 houses in the rocky terrain of Berkeley Heights Township, N.J., proved the tremendous power of the Oliver Model 80 Hydro-Trencher. Replacing two other backhoes, the 80-HT actually increased production 30%, ending the double expense of operating two rigs.

Says contractor Peter Aponti, "What I looked for was a machine that would dig and dig—giving me more production. This is what the Oliver 80-HT does for me! It's a strong machine, the easiest backhoe I've ever operated. And boy! I am well satisfied!"

Municipalities, utilities and contractors know that the Oliver 80-HT is tops for digging in hard soils (even frozen ground), ripping out pavements, and other difficult jobs. It's big; it's powerful! The ½-yd. bucket digs and loads to 12 feet; boom swings 180°. Dual-circuit hydraulics permit raising or lowering bucket while swinging. Results: faster work cycle, more production.

TRY THE 80-HT. See how it digs deeper and faster—for less money. Call your Oliver distributor today for a free trial-demonstration.

THE OLIVER CORPORATION
Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio
a complete line of industrial wheel and crawler tractors and matched allied equipment



For functional flooring material . . .

Specify BLAW-KNOX Electroforged® Steel Grating and Treads

To be functional, a flooring material must be easily installed, and as easily removed for alterations. Blaw-Knox Electroforged Steel Grating is made in rigid, one-piece sections that can be cut to fit neatly around pipes and beams and altered to meet new space demands.

Once installed, flooring must support its load and resist wear. Blaw-Knox grating is *Electroforged* for strength. Bearing bars are not weakened in fabrication by slotting . . . no bolts or rivets to work loose.

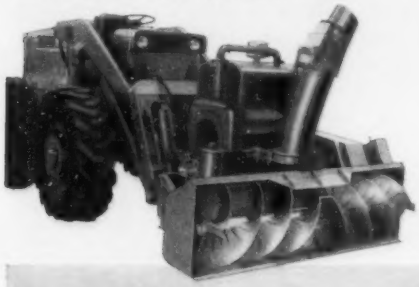
Flooring must be safe to use, and easy to maintain. With its twisted crossbar, and choice of two types of bearing bars (square and serrated) Blaw-Knox grating is the safest possible walking surface in all weather. Grating does not collect oil or grease, dirt or snow. All surfaces are exposed for easy painting, and light and air can pass right through.

For information on how to specify Blaw-Knox Electroforged Grating, write for Blaw-Knox Bulletin 2527-R.

BLAW-KNOX

BLAW-KNOX COMPANY
Blaw-Knox Equipment Division
Dept. W, Pittsburgh 38, Pennsylvania

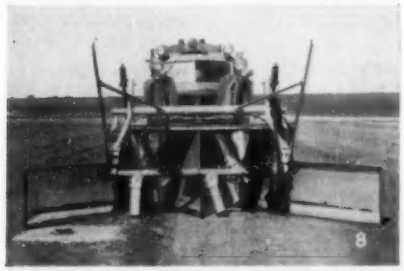
Special models of the BROS Rotary Snow Plows provide added versatility to Michigan Tractor-Shovels, Models 55A, 75A, 85A, 125A and 175A.



Why one or more of these BROS Rotary Snow Plows are vital to your clean-up strategy

The Series "A" Plow for 4-wheel drive Jeeps is a proven performer for parking lot, roadway, industrial driveways and similar snow removal work.

For quick urban street snow removal, a BROS Series "A" for all front-end loader attachments loads out windrowed snow to trucks at 4 to 7 tons per minute.



Available in up to 325 HP models, the BROS M9 provides the power and speed to handle really big snow removal problems for airport runways, mountain passes and highways in the heavy snow belt.

If, as last year, a big snow storm hits your area, you'll surely want a BROS Rotary Snow Plow to perform these vital snow removal operations:

- Fast loading out of windrowed snow to maintenance trucks. Up to 10 tons per minute.
- Knocking down high drifts that are impossible to handle with other snow removal equipment.
- Cast away the high snow banks along roadway shoulders to places less hazardous to traffic visibility.
- Casting snow from bridges.
- Emergency snow removal from main thoroughfares and parking lots after heavy snowfall.
- Regular snow removal without building high banks.

This wide variety of snow removal operations makes the BROS Rotary Snow Plow indispensable to your maintenance fleet. A wide range of rotary snow plow capacities, truck or loader mounted. Write for nearest dealer.

BROS

BROS *Incorporated*

ROAD MACHINERY DIVISION

1057 Tenth Ave. S. E. • Minneapolis 14, Minnesota

To order these helpful booklets check the reply card opposite page 34.

STREET LIGHTING AND TRAFFIC CONTROL

Steel and Aluminum Lighting Standards

34. Street and highway lighting standards, floodlighting standards, traffic signal standards and arms, strain poles, brackets and mast arms and accessories are some of the units described in catalog from Kerrigan Iron Works Company, P. O. Box 479, Nashville 2, Tenn.

Lighting Standards for Every Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Hy-Lite standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

Electric Plants, Warning Flasher Lights and Concrete Vibrators

348. Models, specifications, accessories and other data on flasher lights, electric plants and vibrators are covered in catalog from Pacific Mercury, P. O. Box 190, Van Nuys, Calif.

3M Letters for Large Reflectorized Signs

374. "3M Signal" letters are made with "Scotchlite" reflective sheeting encapsulated in acrylic plastic and are used on large reflectorized signs. Check the reply card or write Minnesota Mining and Mfg. Co., St. Paul 6, Minn., for full details.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans.

Tomorrow's Lighting on Today's Streets

79. Bulletin GEA-6989, 12 pages, illustrates how several cities, both large and small, met the challenge of poorly lighted downtown areas. Check the reply card or write General Electric Co., Schenectady 5, N. Y., for data on mercury, fluorescents and filament lighting luminaires.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote Corp., P. O. Box 2066, Jackson, Miss.

Street Lighting Poles for Streets and Highways

443. Standard designs, assembly details, suggested pole sizes, base construction details and bracket arm details are some of the details covered in this 22-page catalog. Check the reply card or write The Union Metal Mfg. Co., Canton, Ohio, for Catalog No. 78-A on street lighting poles of modern designs for all streets and highways.

Aluminum for Complete Line of Signs and Sign Blanks

675. Valuable information on aluminum's advantages, features and economies, plus details on application of all sign message materials are covered in the aluminum sign bulletin from Kaiser Aluminum & Chemical Sales, Inc., Dept. MU-936, 919 N. Michigan Ave., Chicago 11, Ill. Check the reply card today.

Literature on Reflective Glass Beads

690. Glass beads for traffic signs and street name signs are described in literature available from Flex-O-Lite Mfg. Corp., 8305 Flex-O-Lite Drive, P. O. Box 3066 (Affton Br.), St. Louis 23, Mo. Beads can be used on white and yellow signs. Check the reply card.

BUSINESS ADMINISTRATION

Save Space By Filming Your Records

57. Microfilm your records by using the Recordak Microfilmer. Check the reply card or write Recordak Corp., 415 Madison Ave., New York 17, N. Y., for operation, use and price of this machine. Also available is literature on the Recordak Verifax Copier that makes certified copies 15 times faster than typing.

If You are Considering a Bond Issue Check with Chase Manhattan

236. For details on bond issues for any municipal or governmental unit, write The Chase Manhattan Bank, 40 Wall St., New York 15, N. Y. Check the reply card.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

WEED AND DUST CONTROL

How to Cut Weed Control Costs

308. Information on a weed killer that can save hundreds of man-hours of clearing and cutting is available from Diamond Alkali Co., 300 Union Commerce Bldg., Cleveland 14, Ohio. Whether you want to control weeds or brush or both, without damage to crops or ornamentals, get this literature today by checking the reply card.

*THE NAME ORANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE ORANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg *Root-Proof* Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalies found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

The Silver Band* identifies *genuine* Orangeburg: *Root-Proof* Pipe for sewer lines; *Perforated* Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. PW-109 for Engineer's independent report.

ADVERTISED IN LIFE

ORANGEBURG MANUFACTURING CO.
Orangeburg, N.Y. Newark, Calif.
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

genuine ORANGEBURG®
Root-Proof Pipe and Fittings

more oomph

Like some people, some derricks have a little extra oomph. This derrick—Holan's Series 6800 has it . . . especially in the lower operating ranges.

The 6800 has extra strength because of extra lift cylinders—four instead of two. It lifts 2,000 pounds when only 5½ feet from the ground . . . body-loads 4,000 pounds. Capacity is 8,000 pounds.

More digger oomph, too

The digger here is Holan's 3-speed Series 5400. Maximum torque is 8,400 foot-pounds—tops by far among derrick-suspended diggers. With the power of the derrick and digger combined, you could bore through just about anything.

If you are in the market for power equipment with that extra oomph, get in touch with a Holan Field Representative.

Holan Corporation, 4100 West 150th Street, Cleveland 35, Ohio
Plants in Cleveland, Ohio; Griffin, Georgia; Phoenix, Arizona

Holan

Subsidiary of THE OHIO BRASS COMPANY

HOLAN

To order these helpful booklets check the reply card opposite page 34.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Snow Plows For Every Need

296. Frink snow plows are designed to meet snow removal needs at airports, parking lots and streets and highways. They consist of four basic types with models to fit trucks 1½ to 12 tons. For complete data write Frink Sno-Plows, Inc., Clayton, N. Y.

Rock Salt For Ice and Snow Removal

534. Application rates and procedures of using Morton rock salt for ice and snow control are covered in catalog from Morton Salt Co., 110 No. Wacker Drive, Chicago 6, Ill. Check the reply card for Catalog F-35.

Snow Plows For Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

Catalog on Equipment For Ice and Snow Control

215. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co., Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Ice Control Without Corrosion Dangers

439. Virtually all corrosion is prevented when rust inhibitor "Banox" is used in conjunction with salt for snow and ice control. Properties of this material and performance results are described in bulletins issued by Calgon, Inc., Hagan Bldg., Pittsburgh 30, Pa.

Formulation for use in Thermal Snow and Ice Removal Systems

493. The properties and advantages of Dowtherm SR-1, a heat transfer fluid, and typical installation layouts are covered in catalog available from The Dow Chemical Co., Midland, Mich.

Lift or Lower Snow Plows Automatically

540. Battery operated or fan-belt driven hydraulic controls that lift or lower snow plows are described in literature from Monarch Road Machinery Co., 1331 Michigan St., N.E., Grand Rapids 3, Mich. Check the reply card.

Spreading Equipment For Ice Control

543. An ice control catalog describing the full line of Baughman ice control spreading equipment has been released by Baughman Mfg. Co., Jerseyville, Ill. Included are illustrations and descriptions of truck-mounted spreader bodies, tail gate spreaders, dump body and pull type spreaders and gravity feed spreaders. For your copy of this helpful and interesting booklet check the reply card today.

REFUSE COLLECTION AND DISPOSAL

Versatility, Compaction Force Account For Extra Packer Capacity

159. The many advantages of this modern packer unit have been combined into a fact-filled bulletin entitled "The Big Squeeze" which is available from E-Z Pack Div., Hercules Galion Products, Inc., Galion, O.

Methods and Benefits of Sanitary Landfill

409. Information on Sanitary landfill methods, organization and necessary equipment with which to carry out the job is available from the Construction Machinery Div., Allis-Chalmers Mfg. Co., Milwaukee, Wis.

Information on the Hydepak Refuse Packer

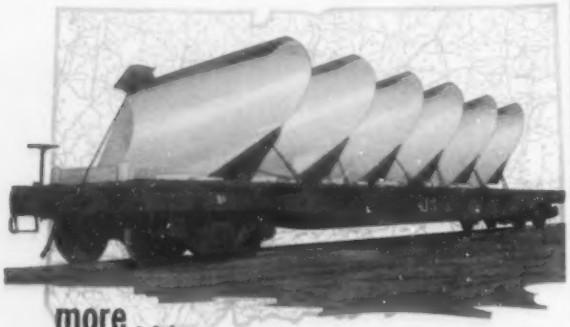
437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

Sanitary Landfill By Moving Earth Only Once

485. "How to Construct a Sanitary Landfill" with a minimum amount of earth moving is the subject of a 20-page manual, illustrated with how-to-do-it drawings and containing helpful cost data. Write Drott Mfg. Corp., Milwaukee 15, Wis., or check the reply card.

Modern Methods in Sanitary Landfills

699. Up-to-date data, pictures and explanation of sanitary landfill, its methods and equipment are covered in this valuable bulletin from The Oliver Corp., 19300 Euclid Ave., Cleveland 17, O. Check the reply card for information on satisfactory garbage and refuse disposal methods.



more . . .

GLEDHILL SNOW PLOWS

are off to Connecticut . . .

Rugged GLEDHILL SNOW PLOWS will do Connecticut's job best!

When you're dealing with public highways you're committed to do the best possible job. Connecticut chose Gledhill Snow Plows to handle their snow removal problem.

GLEDHILL *America's first choice in* SNOW PLOWS

THE GLEDHILL ROAD MACHINERY CO., Galion, Ohio

PALMER

FILTER BED AGITATORS

TECHNICAL ADVANTAGES

- 1—Requires an average of 40% less wash water
- 2—Completely eliminates mud balls
- 3—Eliminates cracking or shrinking of the beds
- 4—Produces "new" filter media after short period of normal operation
- 5—Turns out purer, better tasting water
- 6—Low installation cost
- 7—Low operating cost
- 8—More water through the filters
- 9—Less "time out" washing filters

PALMER

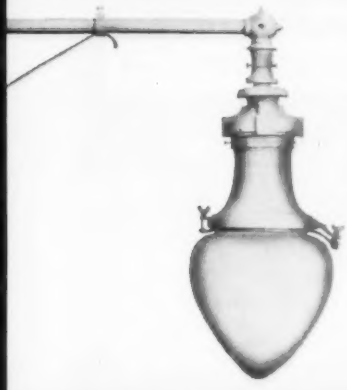
ANTHRAFILT FILTER MEDIA

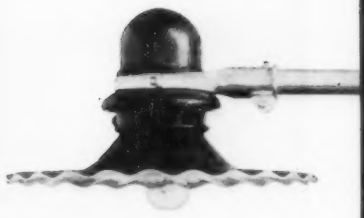
FAR SUPERIOR to Sand or Quartz Media, as it Double length of Filter runs, nearly halves wash water needs; with less coating, caking, or balling.

Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

PALMER FILTER EQUIPMENT CO.
822 E. 8th St. • Erie, Pa.

If your lighting equipment looks like this . . .





and your streets look like this . . .

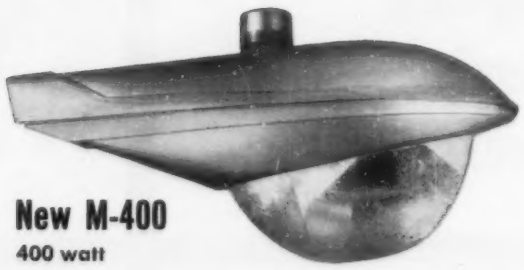
then . . .

GO MODERN

with General Electric

New beauty, safety, efficiency

New M-250
175-250 watt



New M-400
400 watt

For RESIDENTIAL STREETS . . .

. . . LIGHT TRAFFIC STREETS . . .

. . . ENTRANCE AND EXIT RAMPS

For HEAVY TRAFFIC STREETS . . .

. . . HIGHWAYS . . .

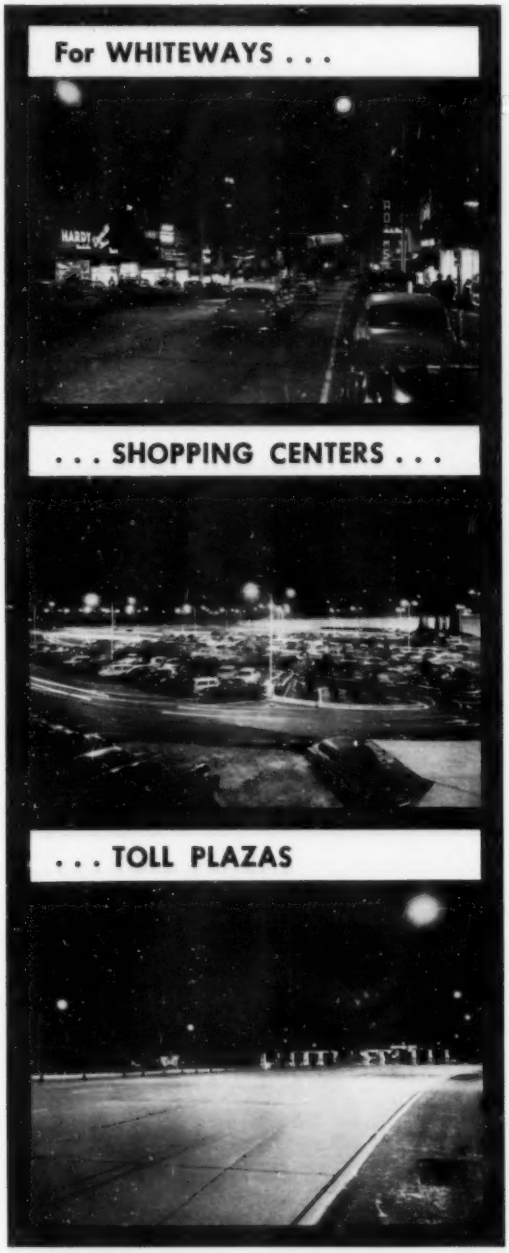
. . . BUSINESS STREETS

for every street and highway

New M-1000
700-1000 watt

GO MODERN

with General Electric's new mercury luminaires



Combining the world's newest, smartest styling with outstanding performance and economy, General Electric's new mercury luminaires present the same basic design in every unit. And, there's a unit for every roadway lighting application.

From 175-watt applications on light-traffic streets to 400-watt applications on business and traffic streets and highways to 1000-watt applications on whiteways, these luminaires provide long, highly efficient service. 100% designed by General Electric—with components engineered to work together—these new luminaires feature:

Power Pack design with built-in ballast in all units; all wattages, including 700 and 1000 watts.

Terminal board is pre-wired, requires only two connections, eliminates splicing, reduces installation time.

Four-position socket allows selection of IES light distributions with a simple screw setting.

Universal slipfitter accommodates either 1¼- or 2-inch bracket with a quick adjustment—no additional parts.

Sealed optical assembly with silicone rubber gaskets—blocks entry of bugs and dust.

New photoelectric control has long-life G-E cadmium sulphide cell for guaranteed dependability.

Acrylic refractor on M-250 unit, a G-E exclusive, and heat-resistant glassware on larger units reduces breakage.

See your G-E Sales Engineer or Agent today for further information; or use coupon below.

Progress Is Our Most Important Product

GENERAL ELECTRIC

Section B450-6, General Electric Co., Schenectady 5, N. Y.

Please send me:

☐ GEA-6943 New Mercury Luminaires

☐ GEA-6987 New Photoelectric Control

Name_____

Company_____

Address_____

City_____ State_____

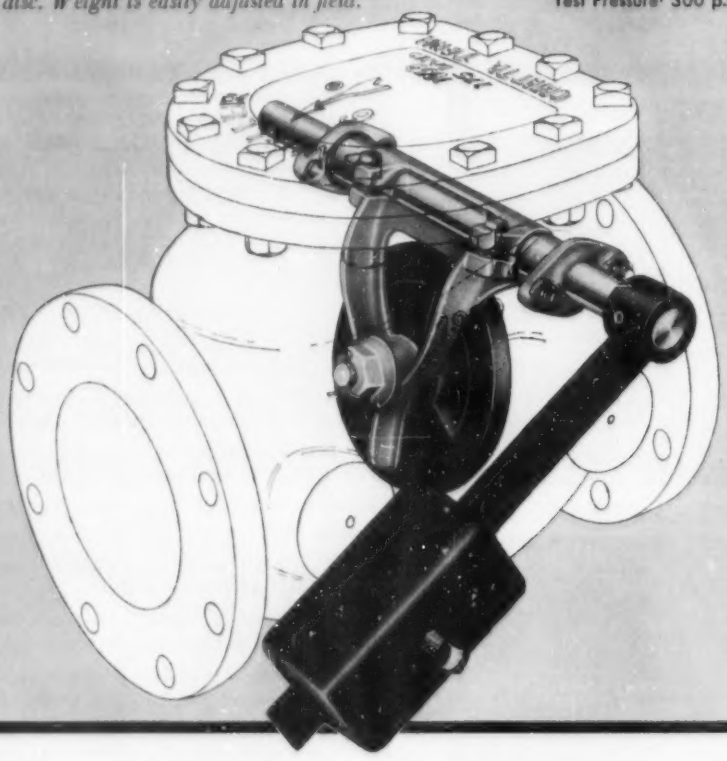
MUELLER® Check Valves

heavy duty disc assembly that lasts and lasts!

Lever and Weight Type

. . . ideal for use in pump suction or discharge lines to cushion and reduce slamming and hammering. Lever may be positioned to speed up or slow down closing of disc. Weight is easily adjusted in field.

Iron Body — Fully Bronze Mounted
Bronze Seat Ring
Bronze Disc Ring or Rubber Faced Disc
Flanged, Screwed or Hub Ends
Working Pressure: 175 p.s.i.
Test Pressure· 300 p.s.i.



All working parts of these new Mueller Swing Type Check Valves are heavily made to assure long service life and dependable operation *without maintenance.*

A heavy stainless steel hinge pin is used on all lever and weight type (shown) and lever and spring type check valves. This pin is extended through the hinge plugs to permit the lever to be used on either side of the body. An "O" ring on the plug prevents leakage around the pin.

The plain type, without lever, weight or spring, uses a new combined hinge pin and plug which is securely and accurately held to the body by studs and nuts. An "O" ring positively seals the plug to prevent leakage.

Large, wear-resistant bearings and a full-width clapper arm hinge, used in all types, accurately and rigidly align the disc to eliminate chatter and vibration.

These new, heavy duty check valves have been specifically designed for repeated opening and closing applications in water works pumping stations, water filtration plants, sewage treatment plants and general industrial plants. They are suitable for horizontal or vertical installation on water or oil lines.

Write for specifications.

The many exclusive features of these new check valves are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product.

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

TELETAX* TELEMETERING

by Foxboro...

engineered for the most advanced transmission techniques

Telemetering matched in performance with famous Foxboro instruments — that's the Foxboro Teletax Telemetering System.

Through use of impulse-duration signals, Teletax electrically transmits measurements of a remotely-located variable to the central control station. Here, the Teletax receiver records the duration of impulse, which is directly proportional to the measured variable.

The Foxboro Teletax System is noted for its simplicity, its versatility, and its high sustained accuracy. For a transmission medium, it can use either AC or DC, an audio frequency carried on a transmission line, or radio or microwave impulses. Sustained accuracy is 0.5% of full scale.

TELETAX RECEIVERS

Teletax receivers include: Single or Dual Receivers; Multi-Record Receivers for recording up to 6 separate measurements on one chart; and Teletax Receiver-Controllers for automatic operation. And the Teletax signal can be simply converted to digital information.

TRANSMISSION LINK

With Foxboro's Teletax Telemetering System, you can use the most advanced transmitting techniques: two wire lines, power lines, radio or microwave. As many as 25 different signals can be handled in each direction, simultaneously.

TELETAX TRANSMITTER

The Teletax Transmitter houses either one or two standard Foxboro measuring elements — plus the Teletax transmitting mechanism. It will transmit to a control center hundreds of miles away just as easily as to one nearby. It also indicates or records locally if desired.

The Teletax Transmitter needs no periodic maintenance whatever, while the receiver requires only occasional oiling. And the receiver has a minimum of mechanical components to wear — no clutch to slip or jam.

Foxboro Teletax Systems are now in wide use on natural gas systems, water works, oil fields, power plants, steel mills, etc. Write for Bulletin 17-11C — it gives all the details. **The Foxboro Company, 2610 Norfolk Street, Foxboro, Mass.**

*Reg. U. S. Pat. Off.

FOXBORO

REG. U.S. PAT. OFF.

TELETAX TELEMETERING

4 systems to cut your

DEMPSTER DUMPMASTER®

If your hauls are getting longer, here's the system for you. The Dumpmaster handles 1/2 through 8 cu. yd. containers . . . gives you all the advantages of rat-proof, scatter-proof, fire-proof, enclosed refuse storage . . . plus peak efficiency when used on hand-loaded routes. It's safe! Clearance arms bridge cab. Economical! Hydraulically compacts 50 to 120 cu. yds. of loose refuse per trip, depending on the model. One-man operated, all operations automatically controlled from cab . . . in use from coast to coast.

Covered by U.S. Letters Patent No. 2,900,096

DEMPSTER DUMPSTER®

The DEMPSTER-DUMPSTER System of one truck handling any number of containers has saved municipalities many millions of dollars. All-steel, enclosed, sanitary containers are available up to 15 cu. yd. capacity. Patented sump-bottom containers available for wet or moist refuse. One man, the driver, picks up, hauls, dumps and returns the empty container . . . handles hundreds of yards of refuse daily. Now in use in hundreds of progressive cities.

How YOUR City Can Get a Scientific Analysis of its

Methods and techniques of mechanized refuse handling have undergone many revolutionary changes in the last 18 months. That's why far-sighted city officials from coast to coast are surveying . . . examining and comparing their present systems against these new developments.

Disposal areas are moving farther and farther out; new shopping, commercial and manufacturing areas are springing up to compound the city's refuse disposal problems and throw more burden on the tax dollar. To meet these specific problems, new equipment has been developed—some fits in one situation . . . doesn't fit in another.

Dempster Brothers maintains a staff of trained survey engineers who are specialists in analyzing methods of refuse storage, collection, transportation and disposal.

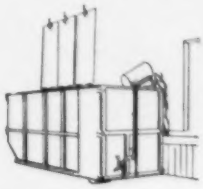
These skilled men are available to assist your planning groups *without cost or obligation*. Each year these engineers make hundreds of surveys in cities

refuse disposal costs

DEMPSTER® DINOSAUR

All structures shown are Patented or Patents Pending
Mfd. by
DEMPSTER BROTHERS
Inc.

The DINOSAUR handles detachable containers up to 40 cu. yds. and over, with gross loads of up to 15 tons. One man, the driver, picks up, hauls and dumps or puts down the giant containers on platform, ground or legs. Everything is handled hydraulically from controls in the cab . . . no winches, cables or sheaves. Can handle two or more containers at a time. Big capacity and big pay loads beat the long-haul problem. Excellent for use at big refuse generation points or as a portable transfer station for conventional packers.



DEMPSTER COMPACTION TRAILER & GRD 304-F-2

Big-capacity hydraulic compaction trailers have own power plant, haul up to 200 cu. yds. of loose material on every trip to the disposal area. Can be loaded with GRD 304-F-2, or ramp-loaded by DEMPSTER-DUMPSTERS, or conventional packer trucks. Available in two sizes, 42 and 53 cu. yds.

Disposal Methods FREE!

large and small. They meet and consult with municipal personnel at all levels, analyze costs, ordinances, capital outlay and then present a comprehensive report that compares present methods with other available techniques. Because of their experience and broad knowledge of *all* types of equipment, they are able to make many valuable suggestions even when Dempster Brothers equipment is not indicated.

If you would like to consult with one of our engineers, write today. There is no cost or obligation.

To: DEMPSTER BROTHERS—Dept. PW-10
Knoxville 17, Tenn.

Please send: ☐ Information on Free Survey

Free Brochures on ☐ Dumpmaster ☐ Dinosaur ☐ Dumpster ☐ Trailer and GRD 304-F-2.

Name _____ Title _____

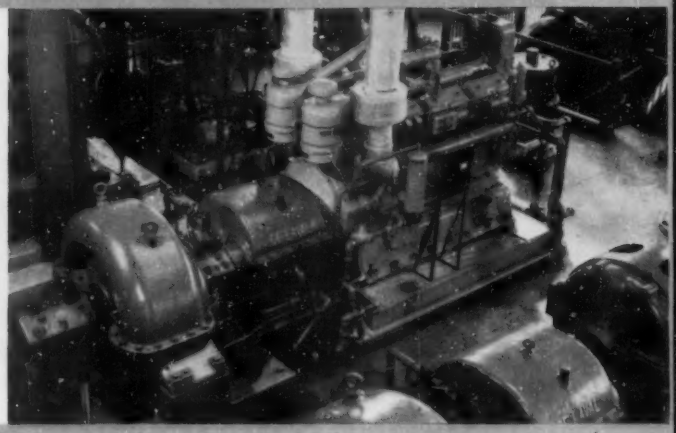
Address _____

City _____ State _____

engine power
BY CATERPILLAR

Caterpillar Natural Gas sewage aerating Engines use "free" fuel in Peoria disposal plant

Exterior view, showing aeration tanks (foreground) at activated-sludge-type disposal plant with separate sludge digestion works. The sewage gas, generated by digestion, provides 600 BTU per cu. ft. high heat value, and "free" fuel for the Caterpillar Natural Gas Engines.



A Caterpillar G397 Natural Gas Engine drives a De Laval centrifugal blower while another Caterpillar Natural Gas Engine drives a Connersville blower. This sewage plant provides service for an actual population of 130,000 but which equals an equivalent population of 275,000 due to industries.

There are no fuel costs for the two Caterpillar Natural Gas Engines which pump air into sewage aeration tanks at the Peoria, Illinois, disposal plant. They use sewer gas, created by digestion, as their fuel.

One of the two engines operates around the clock, throughout the year, with shutdowns for maintenance only. In 17,000 hours of operation, it needed only normal maintenance. On the basis of this engine's performance, a Cat G397 Engine was selected to provide additional capacity. It operates 4 peak-load days a week and acts as standby.

If the methane type gas generated in your disposal processes has high enough heat value, you too can get "free" fuel. And you can cut maintenance costs and reduce the risk of down time. Get the facts on Caterpillar Natural Gas Engines. There are many to get—and they'll all save you money. Write for further information on "Caterpillar Natural Gas Engines."

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Each of the three Caterpillar Natural Gas Engines comes in 7.5:1 and 10:1 compression ratios. The lower ratio is for operation on butane and propane gases. The 10:1 ratio is for methane-type operation.

CDES stands for Caterpillar Diesel Engine Specialist, your engine power consultant. He'll help you select the right equipment, aid on installation, counsel with you whenever you wish.

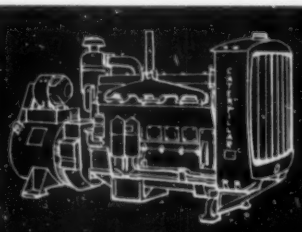
Caterpillar Diesel Engines and Electric Sets are available for your installations—in disposal plants, water works, electric utilities—as primary or stand-by power.

3 Caterpillar Natural Gas Engines to choose from —each with more power in less space

Ratings for Continuous Operation w/o Fan

	7.5:1 Compression Ratio	10:1 Compression Ratio
G342—1200 RPM	200 BHP	225 BHP
G375—1300 RPM	275 BHP	310 BHP
G397—1300 RPM	415 BHP	470 BHP

CDES



It's NEW!
It's FACTUAL!
It's YOURS!

Aluminum Company of America
Pittsburgh 19, Pennsylvania
1709-K Alcoa Building
Gentlemen: Please send me my free copy of the Alcoa *Handbook on Aluminum Traffic Control Devices.*

Name _____

Title _____

Street _____

City _____ Zone ____ State _____

For exciting drama watch "Alcoa Presents" every Tuesday, ABC-TV, and the Emmy Award winning "Alcoa Theatre" alternate Mondays, NBC-TV

Alcoa's 24-page Handbook on Aluminum Traffic Control Devices answers every important question on today's best buys in traffic control.

How do you select proper size aluminum I-beam posts without tedious calculations? How do you save hours of computation and drafting when specifying turnpike signs?

You can get the answers to these and virtually every other question on aluminum traffic devices in a compact booklet published by Alcoa. It includes sections on street signs, extruded signs, embossed signs, panel signs, sign blanks, overhead sign structures and structural posts. There is detailed information on ordering and specifying, installation and mounting, surface preparation and fabrication. Short discussions cover processing methods, storage and handling, stripping, aluminum paint and other background material that can help you get more for your traffic control dollar this year.

To get your free copy of this useful handbook, send in the coupon above. And for additional information on how maintenance-free traffic control devices of Alcoa® Aluminum save taxpayers' money, write to Aluminum Company of America, 1709-K Alcoa Bldg., Pittsburgh 19, Pennsylvania.

Your Guide to the Best in Aluminum Value

ALCOA ALUMINUM

How to keep water in!

All Concrete Masonry

NEEDS CONCRETE PROTECTION

—THOROSEAL PROTECTION!

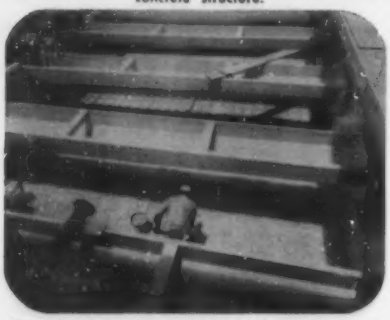
Before THOROSEAL was applied, note porous concrete structure.

Just like concrete, THOROSEAL is cement-based, and therefore perfectly compatible with the concrete masonry to which it is applied; actually becomes part of the structure!

Here, the City of Miami's Department of Water and Sewers Maintenance Crew is applying THOROSEAL to all the masonry of their new 2,500,000 gallon Alexander Orr Filtration Plant. Although the poured concrete structures of these tanks are excellent examples of engineering, it was imperative that they would not deteriorate from constant water pressure.

The interior and exterior surfaces of the elaborate structure were given one brush coat of STANDARD GRAY THOROSEAL and one trowel coat of PEARL GRAY THOROSEAL. THOROSHEEN RW 7, acrylic masonry paint, was applied over the THOROSEAL, for extra beauty, in several areas.

The City of Miami's foresightedness in taking these precautionary steps will save them thousands of dollars in maintenance costs and water loss due to leakage.

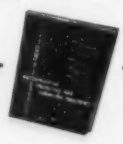


THOROSEAL has now completely filled and sealed the concrete against all weathering and loss of water.

THOROSEAL also protects the outside masonry of filtration plant against the elements and deterioration.

Contractor—PITT CONSTRUCTION COMPANY.
Subcontractor—
FRED HOWLAND CONSTRUCTION COMPANY.

Write for our new 20 page Specification, Guide No. PW-17 just off the press.



Standard Dry Wall Products Inc.
BOX X, NEW EAGLE, PA.

SLUDGE DATA & MEASUREMENTS

The comments by Mr. Rankin on raw sludge removal from primary settling tanks in your August, 1959, issue make interesting reading. The discontinuance of raw sludge removal by gravity methods has this writer's full backing. The method should be abandoned in favor of positive removal by plunger sludge pumps.

A method of roughly determining the percentage of solids in raw sludge, not mentioned by Mr. Rankin, is to weigh a fixed volume of sampled sludge on a pan balance. Laboratory work will confirm the weight below which pumping should be stopped.

Mr. Rankin's comment that a device employing an isotope with probing rays may be developed to measure the density of a moving column of sludge is by no means futuristic; in fact, Industrial Nucleonics Corporation is offering a density measurement instrument based on the absorption of radiation by materials. Changes in density per unit volume varies the amount of radiation absorbed, thus providing basic measurement of density, percent solids or specific gravity. The current produced by the radiation detector is amplified and can be read on a meter or recorder in the proper units of measurement. Although this device has had limited practical usage, it shows promise of giving immediate information on the density of pumped sludges and undoubtedly will see application at sewage treatment plants in the future.

LeRoy W. Van Kleeck
Principal Sanitary Engineer
State Department of Health
Hartford, Conn.

COMPOSTING REFUSE

I have read with much interest your editorial in the August issue "Two Other Factors of Importance

When is it wise to "put all your egg-shells (and other refuse) into one basket?"

NOW . . .

with HOBBS-HYDEPAK Container System

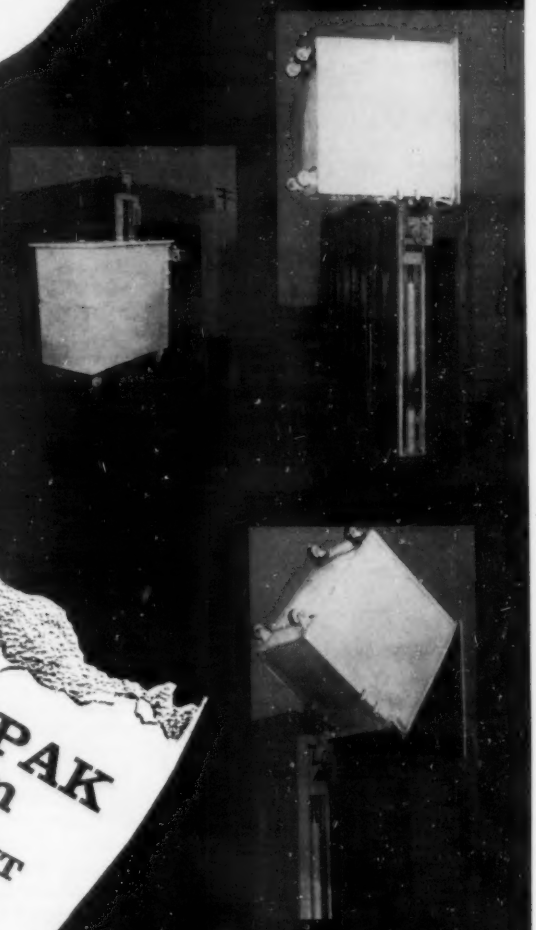
LOWER INITIAL INVESTMENT

GREATER RETURN ON YOUR INVESTMENT BECAUSE:

Multiple uses of unit include handling of residential, commercial and industrial refuse;

Safety and simplicity is assured by positive one-valve operation—

And can be loaded from dock, street, or intermediate levels.



HOBBS HYDEPAK

Hobbs Trailers

609 North Main, Fort Worth

EBMI
Underground Boring Machine
New! Improved!

Model 70

- **BORES**—with no surface break
- **BORES**—up to 250 feet in length
- **BORES**—up to six inches diameter
- **BORES**—so drill stem of pipe of conduit stays
- **BORES**—1,000 feet on 1 Gal. of gas
- **REAMS**—up to 12 inches diameter

Write immediately for information.

EARTHWORM BORING MACHINE, INC.
P. O. Box 1100
Santa Monica, California

FISHER Finds it Faster!

All-new 1959 Transistorized
M-SCOPE PIPE FINDER *only* $189.50

- Greatest depth penetration
- Greatest tracing distance
- Pinpoint accuracy
- One year between battery changes
- Built-in battery testers
- 90% less maintenance costs

New, Transistorized
LEAK DETECTOR

- Finds leaks faster, more accurately
- Weighs 80% LESS than ordinary equipment.

only $295.00

SEND FOR FREE 1959 CATALOG
FISHER Research Lab., Inc.
Dept. PW-5, Palo Alto, Calif.

in Composting Refuse." These two factors mentioned are (1) material handling; and (2) a sound selling program developed.

Now taking the two points above, you are certainly absolutely correct about the second. A sound selling program must be developed to get rid of the enormous amount of compost which can be produced—and economically too. I have some ideas on that. Now with item #1—with that I just cannot agree. Of course the machinery is not now offered for sale. Why should it be when there is no demand for it? This still does not create any problem. There are many fine pieces of high capacity machines on the market which with very little adaptation can easily do the work for any size operation. As City Engineer of Phoenix, Arizona, for many years, I spent much time making compost tests. All the answers are available for cheap compost except a sound selling program. Most of the literature concerning compost is almost worthless; nearly all methods require much processing and labor. I have developed a process which largely eliminates that factor and I know that it can be produced without tanks and complicated processing machinery for about $3 per ton, including composting of all garbage and municipal refuse, street sweepings, wood limbs, paper—everything hauled to the dump except metals and plastics and why worry about them—the metal can be reclaimed magnetically, the plastics thrown out in screening.

Richard Bennett
Construction Consultant
Saratoga, California

HISTORY OF THE ARMY MSC

The U. S. Army Medical Service Historical Unit in Washington, D. C., under the direction of The Surgeon General, is actively engaged in the preparation of a history of the U. S. Army Medical Service Corps. The introductory chapter of this volume will show by historical example and analogy the background that led to the establishment of the former Sanitary, Medical Administrative, and Pharmacy Corps as well as the present day Medical Service Corps within the Army Medical Department and the Army Medical Service. Other chapters will be devoted to the discussion of the detailed organization, administrative aspects, and achievements of the Medical Service Corps and each of its progenitor corps.

Military documents of all descriptions, records or articles of professional and scientific significance, personal letters, and photographs which relate to the activities of the present Medical Service Corps and each of its predecessors are needed to highlight this history and to augment official references.

It will be greatly appreciated if individuals who possess such material will forward it directly to the: Director, Historical Unit, USAMEDS, Forest Glen Section, Walter Reed Army Medical Center, Washington 12, D. C.

Any material forwarded to the Historical Unit will be returned to the owner after duplication of this material if that is his wish or the material will be retained and filed in the Historical Unit.

C. A. Pendlyshoh,
Lt. Colonel, MSC.

• • •

Task Force Method of Inspecting Defective Buildings

In Chicago, a mass or task force method of inspection is used to detect and correct building violations and get prompt and effective legal action instituted. Last year eleven teams were reported at work. These consist of an Assistant Corporation Counsel and inspectors from the Building, Health and Fire Departments and the Housing, Plumbing and Electrical Bureaus. When a Judge hears at one time evidence of all the violations found and is thereby given a word picture of the total condition of the building as it relates to health and safety, he is much more likely to act effectively than if these violations are presented individually, one at a time and at intervals.

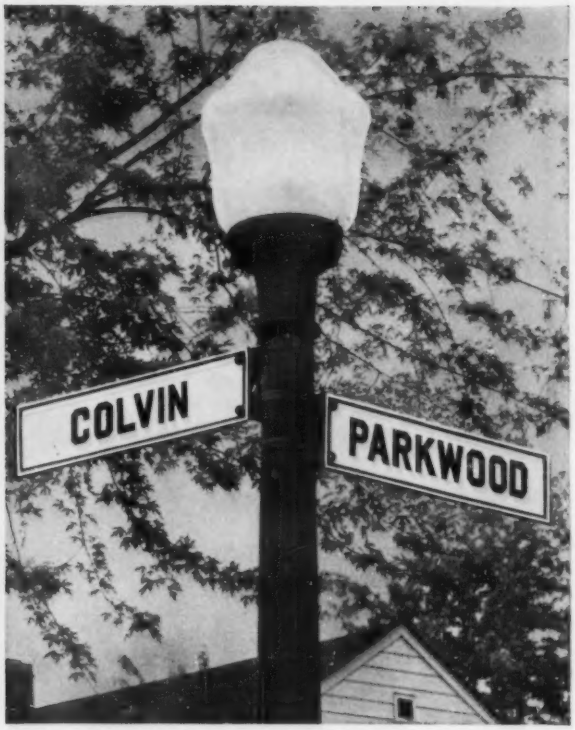
Water Consumption Increases

When Dickinson, N. D., contracted with the Bureau of Reclamation in 1953 for water from the lake behind Dickinson Dam, it was estimated that the water consumption, then 216 million gallons per year, would be 274 million gallons yearly by 1990. However, due to both increased population and increased water use, the 1958 consumption was 285 million gallons.

Water Consumption in Milwaukee

Based on city population, water consumption in Milwaukee, Wisc., in 1958 was 173 gpcd; based on both city and outside city, consumption was 170 gpcd. The system is 98.06 percent metered.

Cast aluminum street signs like these were installed in Tonawanda, New York, 30 years ago . . . one of the first such installations in America. They're still going strong today.



Modern signs of aluminum sheet now grace Tonawanda's newer street corners. Today, virtually all of the township's sign needs are served by lightweight, rustproof aluminum.

30 YEARS LATER: THE DESIGN HAS CHANGED . . . THE **MATERIAL** REMAINS THE SAME!

"No need to sell *us* on aluminum!" says Russell Corrie, Township Superintendent, Tonawanda, N. Y.

"We've seen its advantages demonstrated over three decades. For rustproof durability, quick installation and lifetime economy no other material can match aluminum."

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

Let us make a bid. For expert service on money-saving aluminum signs, call the manufacturer, fabricator or Kaiser Aluminum sign blank jobber near you.

Berkeley, Calif.
Hawkins-Hawkins Co., Inc.
Charlotte, Mich.
Paul H. Callender Co.
Chicago, Ill.
Bell & Gustus, Inc.
Federal Sign & Signal Corp.
Cleveland, Ohio
Osco Steel Co.
U. S. Steel Supply
Clinton, Mass.
Standard Sign & Signal Co.
Dallas, Tex.
All Quality Sign & Mfg. Co.
Elmira Heights, N. Y.
Eastern Metals of Elmira, Inc.
Evanston, Ill.
Northwest Screenprint Co.
Grand Prairie, Tex.
Sargent-Sowell, Inc.
Houston, Tex.
Western Sign & Supply Co.
Indianapolis, Ind.
Midwest Fire & Safety Equipment Co., Inc.
Lancaster, Pa.
John I. Nissly Co.
Little Rock, Ark.
Moody Equipment & Supply Co.
Marion, Ind.
Jim Newey and Assoc.
Metairie, La.
W & A Engineers
Miami, Fla.
Biscayne Fire Equipment Co.
Minneapolis, Minn.
Lyle Signs, Inc.
Monrovia, Calif.
Mask-Off Co.
North Tonawanda, N. Y.
Northern Electric Supply Co.
Overland, Mo.
Wiegand Mfg. Co.
Peoria, Ill.
James P. Flynn Co.
Petaluma, Calif.
Kresky Signs, Inc.
Philadelphia, Pa.
Advertisers Service Co.
Rocky River, Ohio
Bowman Western Stamping Co.
Sacramento, Calif.
The Dosch Co.
Spencer, Ind.
Stello Products
St. Louis, Mo.
Parco Supplies
St. Paul, Minn.
Gopher Stamp Co.
Tacoma, Wash.
Traffic Control Signs Co.
Wichita, Kan.
Miro-Flex, Inc.
Williamsville, N. Y.
Markings, Inc.

Send now for free brochure. Gives cost-saving facts and availabilities on traffic control signs made of Kaiser Aluminum. Mail coupon today.

Kaiser Aluminum & Chemical Sales, Inc.
Dept. TS-34, 1924 Broadway,
Oakland 12, California

☐ Please send me your free aluminum sign brochure
☐ Please have a representative call in person ☐ phone

NAME_____

ADDRESS_____

CITY_____ ZONE____ STATE_____

Build a real future for your water department with the new

BADGER Read-o-Matic* REGISTER

a REVOLUTIONARY product.... for a totally new method of reading

Now your water department can look to a future of increased efficiency and economy — through the Badger Read-o-Matic, industry's first *practical* outdoor register.

With this revolutionary new outdoor register, you'll play a major role in community progress . . . by providing consistently better water department operation and service to *every* customer . . . starting with these *immediate* benefits:

BOOSTS WATER DEPARTMENT NET REVENUE

Eliminated: meterman recalls, "read-it-yourself" cards, estimated water bills. Result: reduced reading costs . . . and greater savings because of simplified department accounting and operation.

100% METER READING IN HALF THE TIME — AND NO WASTED CALLS

The Badger Read-o-Matic overcomes the chief problem of indoor reading: depending on the customer to be home. Instead, a meterman can complete his reading route in half the time it used to take by the old method — because the register is **outdoors** and always available.

BETTER SERVICE AND CUSTOMER GOOD WILL

Because the Badger Read-o-Matic is accessible to the meterman at all times, the customer will never be inconvenienced again. Your meter records are always up to date; the customer's meter bills will always be accurate.

*Patents applied for in U. S. A. and foreign countries.

Dynamic New Idea!

Central reading stations

Glamorous *Mayfair,* Milwaukee, marks a new trend in ultra-modern suburban shopping centers. Its *metering system* — trend-setting, too.

A network of Badger Read-o-Matic registers serves Mayfair's more than 85 stores. Meters are located in the stores . . . connected to a central Read-o-Matic reading station for each section as shown in color on the aerial view (right). A typical panel of Read-o-Matic registers at Mayfair is shown below.

Meter reading — just a few minutes' work. And the Read-o-Matic registers are always accessible.

. . . Another in Badger Meter's big parade of new products for better water metering

Key to the Badger Read-o-Matic register — a self-powered generator that requires no outside source of power. It originates its own pulses that are recorded on the outdoor register. The register can be placed as far as one-half mile from the meter itself.

This revolutionary meter-register is another product of Badger's research devoted *exclusively* to the continuous improvement of water meter design, construction and performance.

Write us today. We'll send a free, colorful brochure with full details about the new Badger Read-o-Matic outdoor register.

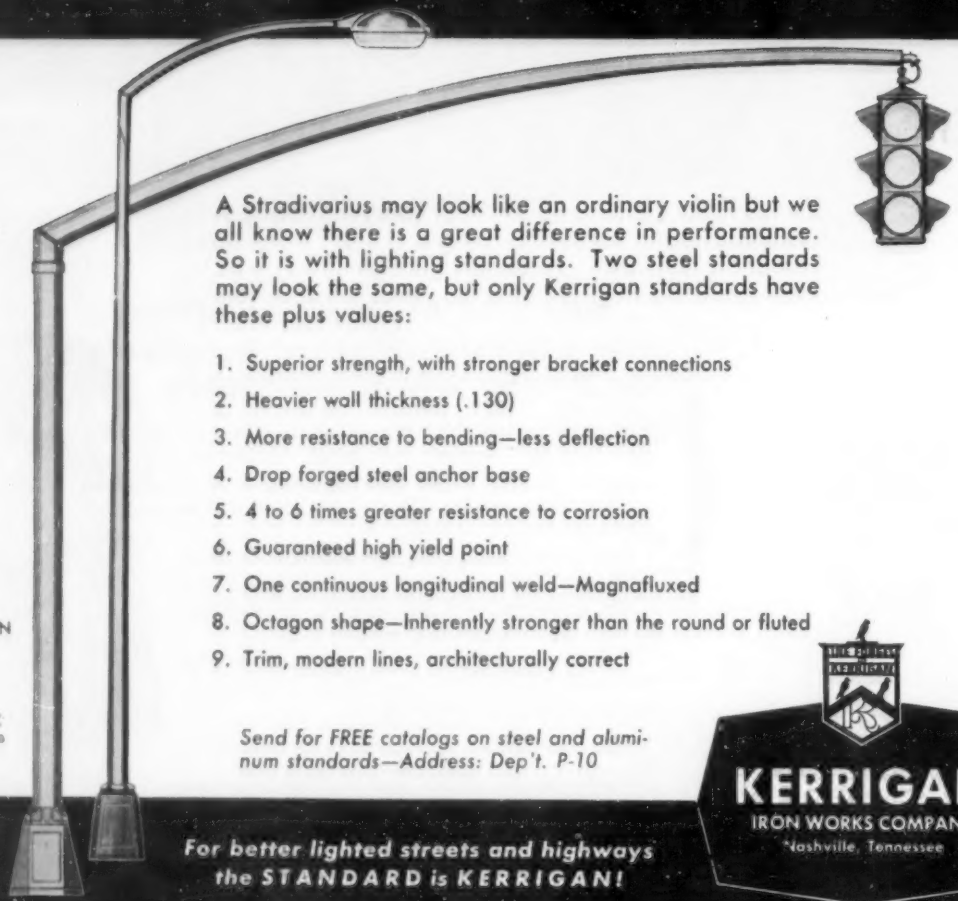
Badger Water Meters

Badger Meter Mfg. Co. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wis.

OFFICES IN PRINCIPAL CITIES

They LOOK alike...

BUT...



A Stradivarius may look like an ordinary violin but we all know there is a great difference in performance. So it is with lighting standards. Two steel standards may look the same, but only Kerrigan standards have these plus values:

1. Superior strength, with stronger bracket connections
2. Heavier wall thickness (.130)
3. More resistance to bending—less deflection
4. Drop forged steel anchor base
5. 4 to 6 times greater resistance to corrosion
6. Guaranteed high yield point
7. One continuous longitudinal weld—Magnafluxed
8. Octagon shape—Inherently stronger than the round or fluted
9. Trim, modern lines, architecturally correct

NEW from KERRIGAN — THE CLASSIC Pat. Pending

Send for FREE catalogs on steel and aluminum standards—Address: Dep't. P-10

KERRIGAN
IRON WORKS COMPANY
Nashville, Tennessee

For better lighted streets and highways the STANDARD is KERRIGAN!

Help for the fall round-up

You don't need a gang of men with brooms and shovels rounding up stray leaves and debris when a "PAYLOADER" with Drott 4-in-1 bucket is on the job, and you don't have to close a street to traffic for clean-up either. The "PAYLOADER" can work close and parallel to the curb, while its clam-action bucket picks up sweeper piles cleanly and dumps them over the truck's tail gate.

Over 10,000 "PAYLOADER" units have gone into public service — more than all other rubber tire unit-design tractor-shovels combined. A big reason for this preference is the wide choice of attachments — many of them exclusive, that make "PAYLOADER" units more versatile — enable them to take the place of specialized machinery in many instances.

Whatever way you measure equipment value, you'll find that "PAYLOADER" — the specialist at *many* jobs — is still the No. 1 buy for public bodies.

7-B-5 R

PAYLOADER®
ATTACHMENTS
help hold down the equipment budget

Drott 4-in-1 Bucket • Wain-Roy Back Hoe
Ram Leaf Loader • Vibratory Compactor
Ram Black-top Spreader • Winch
Ram Pick-up Street Sweeper
Superior Side Boom • Hydraulic Grapples
Ram Rotary Snow Plow
"V", Reversible & One-Way Plows
Angling Backfiller Blade
Crane Hook • Fork Lift • Scarifier Teeth

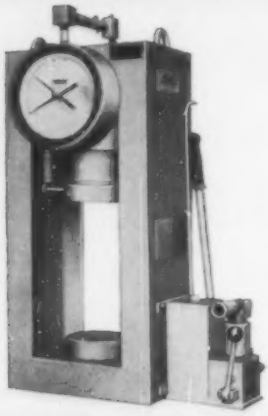
HOUGH®
THE FRANK G. HOUGH CO.
LIBERTYVILLE, ILLINOIS
SUBSIDIARY — INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO., 761 Sunnyside Ave., Libertyville, Ill.
Send "PAYLOADER" catalog "No. 1 in Public Service"

Name _____ Title _____
Govt'l. Unit _____
Street _____
City _____ State _____

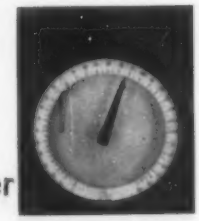
7-B-5

MODEL FT 20
JOBSITE
CONCRETE TESTER



FOR: CYLINDERS, CORES, BLOCKS, BEAMS, CUBES, BRICK AND DRAIN TILE
FORNEY'S INC.
TESTER DIVISION
BOX 310, NEW CASTLE, PA., U.S.A.

New Item . . .
RTM ROTO-TROL
Multi-Circuit Pump Controller

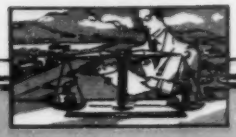


- *Recording and Indication when Desired*
- *Suppressed Head Type*
- *Any Distance between Transmitter & Receiver*

The RTM Roto-Trol operates on the time impulse principle. A tested and proved switching mechanism is operated by a powerful dual motor drive. The motor starters can be controlled direct from the heavy duty mercury switches.

Write for New Bulletin RTM

HEALY-RUFF Company
791 Hampden Ave., St. Paul 14, Minn.



LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

Obstruction of Public Highways

State v. Hull, 97 N.W. (2d) 535, a Nebraska case decided July 3, 1959, was an action to enjoin landowners from continuing to obstruct a road or interfering with public use of the road.

The controversy concerned the existence or nonexistence of a sandhill trail road across the land of the appellants as a public road by prescription. It was contended by the appellees that the road has been a thoroughfare used by the public for more than the statutory period (10 years, in Nebraska), under claim of right, adversely, openly, and continuously, that the road is clearly defined and has been used uninterruptedly and in substantially the identical location, and that Cherry County has recognized the existence of the road as a public highway by contributing to its maintenance, by making improvements to it, and by keeping it in condition for travel during periods of adverse weather.

On Sept. 19, 1956, Clint and Gretchen Hull erected a barrier across the road where it entered their land, and obstructed and prevented the use of the road by the public, including the appellees (Rat Lake Club, Inc., and the Game, Forestation and Parks Commission of the State of Nebraska).

The Hulls, on the other hand, contended that travel across their land had been by their express permission, and not under a claim of right—so that no prescriptive rights had arisen.

Testimony showed that the road had been used as such (under the name of the Rat Lake and Beaver Lake road) for almost 70 years, without anyone asking express permission. The road has always gone in the same general direction, although there have been some divergencies in the course of the road as in the case of any other sandhill road. The road was equipped at its entrance to the land of the appellants and along its course with what is called "auto gates".

The Court said that the presence of these gates was an invitation to travelers to use the road. "The fact that the owner of a tract of land, when enclosing it with a fence, puts a gate in the fence at the place where a right of way is claimed across the tract, is evidence that he recognizes the right of those who use the road to continue to use it."

The Supreme Court of Nebraska concluded that a public easement of way had been established by prescription, and affirmed the judgment establishing the right of the public to continue to use the road.

Icy Sidewalks

Hall v. City of Anoka, 97 N.W. (2d) 380, a Minnesota case decided June 26, 1959, was an action by a husband and wife against the City of Anoka for injuries sustained by the wife in a fall on a public sidewalk which had become covered with snow and ice in the form of uneven ridges, depressions and other irregularities.

There was testimony that this condition had existed 10 days before the accident, that the sidewalk in question had never been shoveled prior to the accident during the winter season and was covered with ice and snow for over a month. A few days before the accident, there had been a blizzard, in which about 8 inches of snow had fallen.

The court pointed out that a municipality is required to exercise reasonable care in keeping its streets and sidewalks in a reasonably safe condition for pedestrians using them. A city is not liable generally for injuries sustained merely because of slipperiness of its sidewalks, but

Q *Why do* **MORE AND MORE** *Cities Buy Hydrocranes?*

A ONE BIG REASON: IT'S ALWAYS A 2-IN-1 MACHINE!

On your busy schedules you have dozens of hit-and-run assignments that require both a *lifting* machine, then *digging* machine. With one Hydrocrane you have both . . . *on the spot!* The Hydrocrane is a crane — lifts 12 tons. Five minutes later, it can be a clamshell. You simply swing around and pick up the bucket from the handy carrying rack, reeve the wire rope, and you're ready to dig in! Hydrocrane versatility saves you *both* time and money . . . lets you handle a bigger schedule with fewer machines.

Your Bucyrus-Erie distributor will give you all the facts. Ask him to prove them with a demonstration. Call him today or write Dept. 2h59A for free bulletin. Bucyrus-Erie Company, South Milwaukee, Wisconsin.

Feature for Feature— it fits your needs!

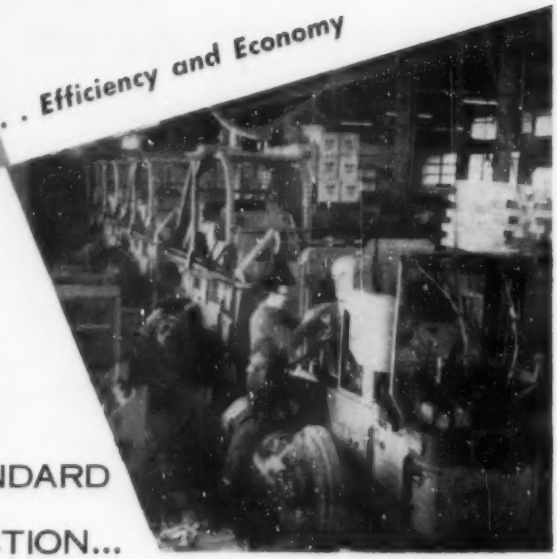
- **Hydrocranes mount on new or used commercial trucks, no special carriers needed.**
- **Power-set outriggers make the rig rock-steady over any kind of ground.**
- **"Gentle as your hand" metered oil controls are smooth, easy to run, boost both production and your safety record!**
- **Hydrocrane's telescoping boom lets you work in close quarters, or stretch out long for a big 70-ft. reach!**

The Hydrocrane's built-in carrying rack is designed to make attaching the clamshell quick and easy . . . a one-man job!

BUCYRUS ERIE ®

Over 50% of all Hydrocranes sold last year were REPEAT SALES!

THE BIG E . . . Efficiency and Economy



NOT STANDARD PRODUCTION...

...BUT PRODUCED TO A STANDARD*

There are still those in the tractor industry that state that the modern Eimco line of tractors and tractor-units just aren't assembly line, mass-produced machines. While, as a matter of fact, our assembly lines, one of which is shown above, are kept very well filled, and additional ones are being built to keep up with the ever-increasing demand for the modern Eimcos, there is some basis of fact in their statement.

Eimcos are **not** built by standard production methods. While mass production standards **are** high, they just aren't high enough for the quality engineering and craftsmanship that goes into every crawler unit bearing the Eimco name. Therefore, Eimco developed a production and assembly technique that is unique, in that it permits production of "custom-built" machines, without assembly interruptions. Everyone of dozens of machines going down the line may have some variation in engineering, engine, tracks, attachments or other components . . . variations, required by the end-use of the unit, that will result in immense savings in greater work-output, less maintenance, for the ultimate buyer of that specific unit.

Sure, it costs more to build a tractor that way . . . but **you** pay no more for a quality-built Eimco. For the folks at Eimco feel that the construction, mining, timber, steel and hundreds of other industries served by thousands of Eimco tractor units all over the world, deserve to get what they expect when they specify an Eimco. More efficiency. Greater economy. Increased work-ability. The advanced engineering and quality craftsmanship for which Eimco has been famous for nearly seventy-five years, and many more extras that you get at no extra cost, with an Eimco.

Why don't you let a qualified Eimco sales-engineer explain and demonstrate the many advantages of the modern, job-proven Eimco line of tractors to you. Just contact the sales office nearest you or write The Eimco Corporation, P. O. Box 300, Salt Lake City 10, Utah, U.S.A.

The highest in the industry!

"ADVANCED ENGINEERING AND QUALITY CRAFTSMANSHIP SINCE 1884"

THE EIMCO CORPORATION

EXPORT OFFICE: 51 - 53 SOUTH STREET, NEW YORK, N. Y.
BRANCHES AND DEALERS IN PRINCIPAL CITIES THROUGHOUT THE WORLD

TRACTOR LOADER DIVISION
494 SOUTH 4TH WEST
SALT LAKE CITY, UTAH — U.S.A.

liability may arise if the City allows ice and snow to accumulate on a sidewalk for such a length of time to cause the formation of slippery and dangerous ridges, hummocks and irregularities. Under the local law, the city can be liable for negligence in this respect only if the condition had existed for 10 days immediately prior to the date of the accident, in the absence of actual notice of the situation.

The Supreme Court of Minnesota held that the testimony was sufficient to go to the jury, and therefore reversed the trial court's directed verdict in favor of the city.

Redevelopment of Blighted Areas

Housing and Redevelopment Authority of City of St. Paul v. Greenman, 96 N.W. (2d) 673, a Minnesota case decided May 29, 1959, involved a condemnation proceeding, in which a landowner appealed from an adverse judgment of the trial court condemning property in connection with a slum clearance project.

The principal issue was whether the Housing and Redevelopment Authority had the power to take property declared to be in a slum or blighted area, under the power of eminent domain, and later sell such property to private persons pursuant to an area redevelopment plan. It was contended that such taking is not for a public use, and hence is unconstitutional.

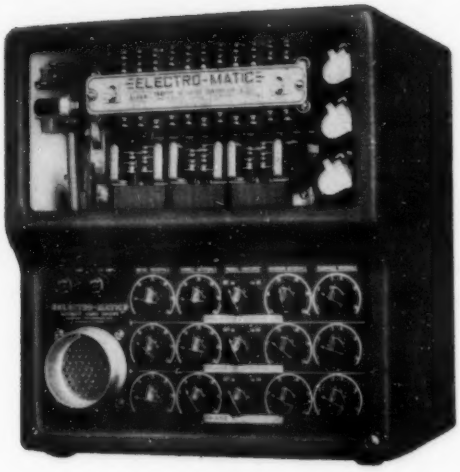
The Minnesota Supreme Court reviewed the cases on this point in other jurisdictions, and concluded that the overwhelming weight of authority is to the effect that, when slum areas have been reclaimed and redevelopment achieved, the public purpose has been accomplished. The fact that there is no necessary *continued* use for a public purpose does not in any way affect the public purpose of the condemnation of the property. In other words, "The achievement of the redevelopment of slum and blight areas . . . constitutes a public use and a public purpose, regardless of the use which may be made of the property after the redevelopment has been achieved."

Thus, the condemnation proceedings were upheld as constitutional.

Cost and Sale Price of Water

It cost the City of Milwaukee, Wisc., for operation and maintenance, $79.94 per million gallons of water pumped. Revenue, on the same basis was $143.39 per mg pumped.

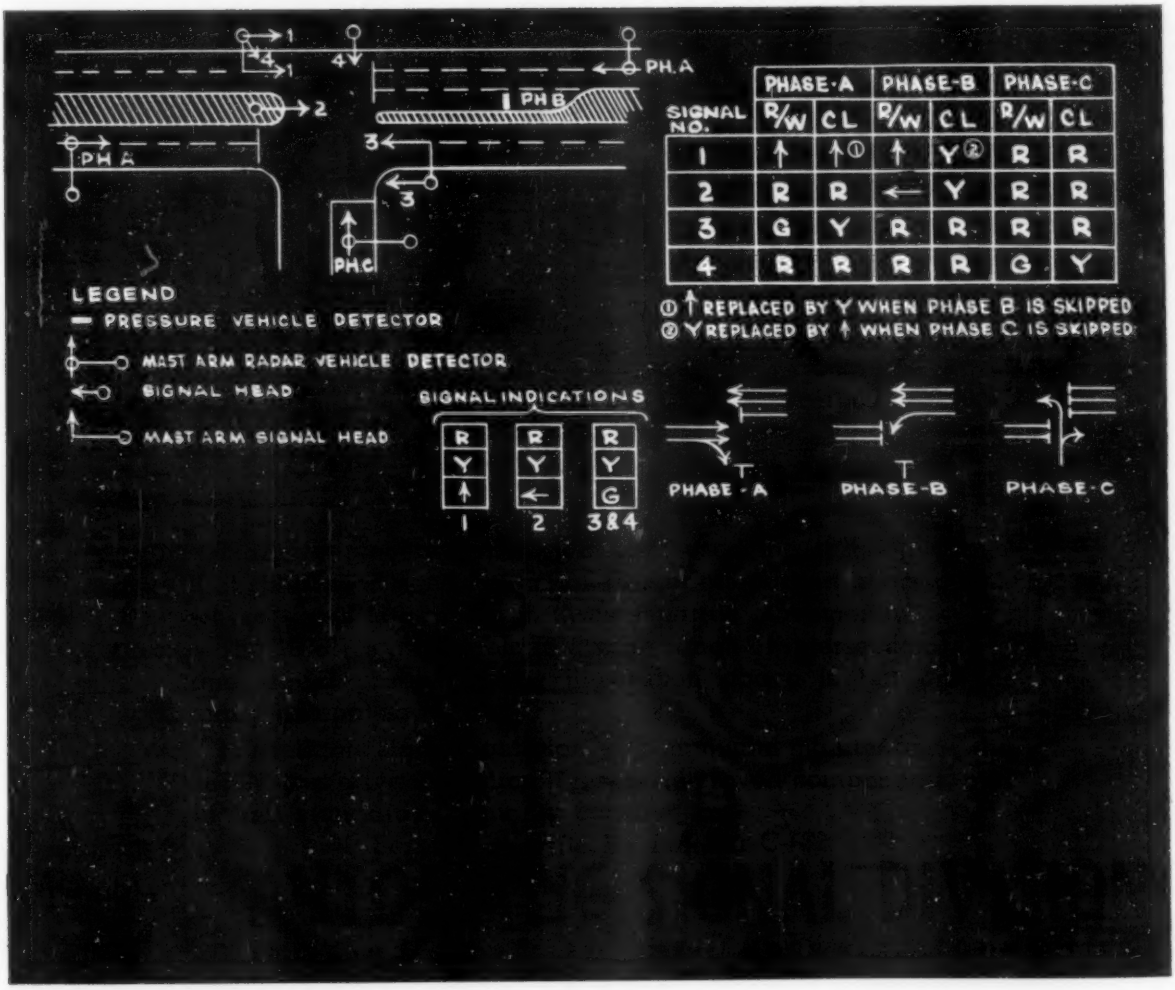
1826N SELECTIVE TRAFFIC SIGNAL OPERATION



Selective Signal Operation is traffic signal control that adjusts to moment-to-moment needs of the traffic itself rather than following a rigid, pre-set pattern of phase rotation and timing.

Model 1826N is a three-phase, full actuated signal controller. It provides selective signal operation by:

- giving green light only to intersection approaches that need it — skipping those momentarily clear of traffic.
- continuously dividing green light time according to the ratios of conflicting traffic flows — regardless of how widely and frequently those ratios vary.



SIGNAL NO.	PHASE-A R/W	PHASE-A CL	PHASE-B R/W	PHASE-B CL	PHASE-C R/W	PHASE-C CL
1	↑	↑①	↑	Y②	R	R
2	R	R	←	Y	R	R
3	G	Y	R	R	R	R
4	R	R	R	R	G	Y

① ↑ REPLACED BY Y WHEN PHASE B IS SKIPPED
② Y REPLACED BY ↑ WHEN PHASE C IS SKIPPED

Core-tested just after completion in 1954 and again in 1958, this street showed a steady gain in strength. Sample shown in photo above was cored in 1958.

On San Diego's La Jolla Ranch Road strength is now 540 psi after just 4 years

...soil-cement pavement grows stronger year by year!

Soil-cement gives more load-bearing strength per dollar than any other low-cost pavement!

Soil-cement is one pavement that really stretches street budgets.

In most cases, 75% of the materials are free! Soil at the site is the main ingredient. Even gravel, or the broken-up old asphalt can be used. This is mixed with portland cement and water, rolled solid and given a bituminous topping. Local traffic can go through on soil-cement pavement right away.

Skilled crews using modern machines can build several blocks a day. And maintenance is kept to a minimum because soil-cement doesn't pothole or soften. It outlasts any other low-cost pavement.

In the last 5 years, the use of soil-cement for roads, streets, shoulders, subbase, airports and parking lots has increased 250%. It's America's fastest-growing low-cost pavement. Write for free information. (U.S. and Canada only.)

PORTLAND CEMENT ASSOCIATION

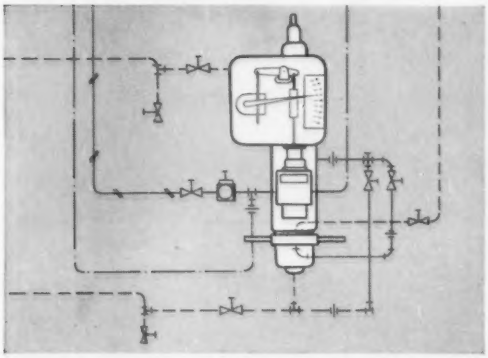
Dept. A10-89, 33 W. Grand Ave., Chicago 10, Illinois

A national organization to improve and extend the uses of portland cement and concrete

MODERN
soil-cement

FLUIDICS

is a Pfaudler Permutit program providing a modern, imaginative approach — plus the specialized materials and equipment — for handling and processing and controlling more profitably the liquids and gases which are the lifeblood of our manufacturing economy.



FLUIDICS AT WORK

New pneumatic transmission system more accurate, more dependable

The diagram shows a typical setup for the new Simplex system for transmitting rate of flow and loss of head to a receiver.

Rate of Flow

The new Type PN transmitter combines the exceptional accuracy and range of a differential converter operated by a mercury float with the traditional dependability of pneumatic transmission.

The transmitter consists of a differential converter which extracts the square root flow function from a primary and then positions a pneumatic motion transmitter. The transmitter produces a pneumatic 3 to 15 psig linear signal. A booster pitot diaphragm in the motion transmitter insures a low lag coefficient and fast transmission.

Besides getting a linear signal without using supplementary pneumatic relays, this new unit gives you point accuracy over wide ranges of flow with minimum differentials. The booster permits accurate transmission over long distances with minimum lag.

Loss of Head

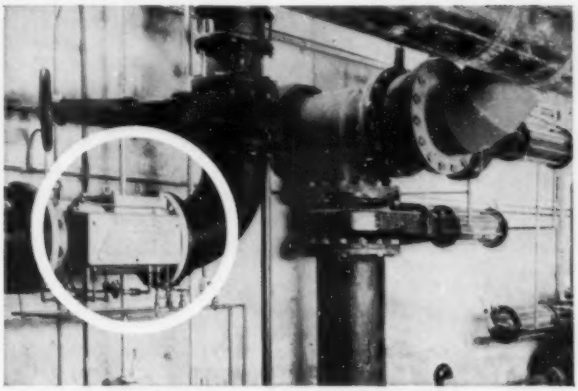
A Type TD transmitter gives accurate readings to within ±1%. It uses no stuffing boxes or relay valves, so both installation and maintenance are simple and economical.

Connected to Simplex Pneumatic Gauges, this new system should give long years of accurate, dependable, trouble-free service.

SIMPLEX®

a division of PFAUDLER PERMUTIT INC.

Specialists in FLUIDICS . . .
the science of fluid processes



FLUIDICS AT WORK

Modulair Flow Controller installs as easily as a piece of pipe

So simple is this new pneumatic rate-of-flow controller, you can install it in about the time it takes to install a piece of pipe.

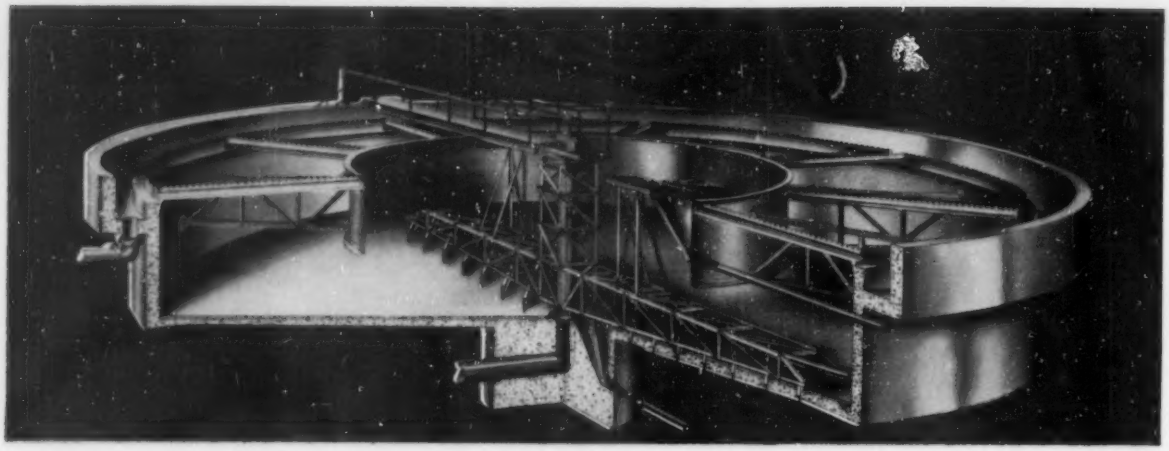
The differential producer and the modulator lie in a single housing. The actuator is entirely enclosed in a case which mounts directly on the housing.

Result: No complicated piping or drain system to install and maintain.

For a bulletin giving complete specs and performance data, write to our Simplex Division, Dept. PW-109, Lancaster, Pennsylvania. Ask for Bulletin 951.

Fast, dependable delivery insured by new plant

This is the new $2,000,000 home of our Simplex Division . . . an ultra-modern plant designed from front to back to give you fast, dependable service on valves and meters. New manufacturing techniques, updated assembly lines and ample manufacturing capacity and a complete staff of skilled workers have all been planned around the single objective of getting your orders to you on time and built to your exact specifications.



Why it Pays to Specify EIMCO-PROCESS Equipment for Sewage Treatment...

In addition to building a complete line of modern treatment equipment, Eimco-Process offers you unsurpassed engineering experience in designing equipment modifications that can result in reduced costs in many treatment operations.

The Flotator-Clarifier, for example, was developed to remove low specific gravity solids by a combination of dissolved air flotation and conventional sedimentation in a single tank. An initial separation of light materials by flotation makes possible a faster settling rate for the solids removed by sedimentation. Removals equivalent to those of a conventional clarifier can be obtained in about half the tank area.

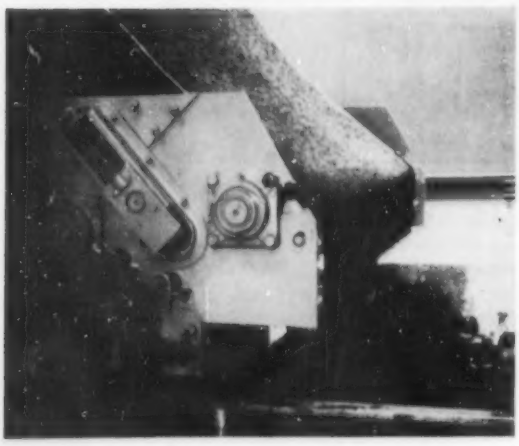
If your plans call for the design of a new plant, the enlargement of present facilities, or the replacement of obsolete equipment, be sure to have an Eimco-Process engineer help you get the right equipment for your job.

Your nearby Eimco-Process representative can draw on a rich background of experience in making equipment recommendations. He can help you integrate the various components of a process into a complete, efficient operation. He can help you "team up" new and existing equipment to get maximum long-term economy. If necessary, be can arrange for laboratory or pilot-scale testing to help you pre-determine operating results before final equipment specifications are made. Write for new Flotator-Clarifier Bulletin SM-1008.

THE EIMCO CORPORATION
Salt Lake City, Utah

B - 450

PROCESS ENGINEERS, INC. *division*
420 Peninsular Avenue
San Mateo, Calif.



...and why it pays to specify Rotobelt for sludge dewatering

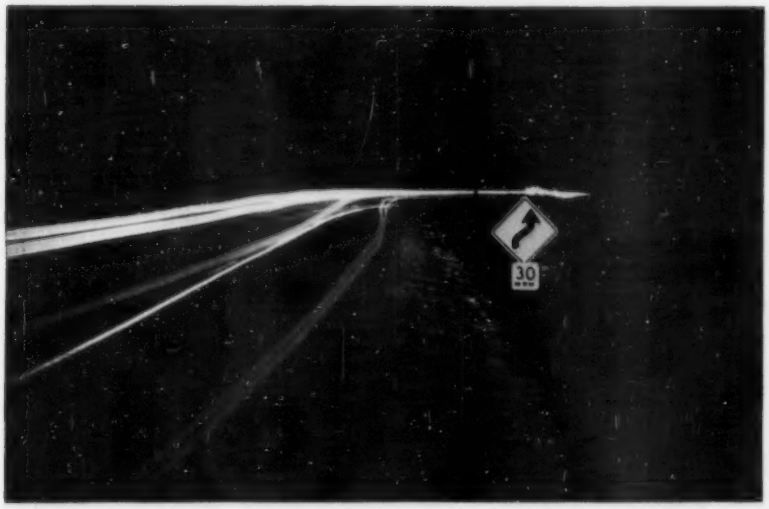
Only Rotobelt vacuum filters can give you complete cake discharge every filter cycle . . . with no blinding . . . and maintain a constantly clean filter medium at all times.

The filter medium is removed from the drum every drum revolution and passed around a small diameter discharge roller. All cake is discharged. Wash sprays clean medium front and back, if necessary, after cake discharge.

There is no fall-off in production. Rotobelt performs as efficiently at the end of a run, or at any time during a run, as at the beginning.

Other advantages — no air blow needed . . . no filtrate blow-back . . . less chemical reagents required.

Why over 700 cities and counties get better signing at lower cost



With a vacuum applicator in your sign shop, you can make all types of professional traffic signs for roads and streets—reflective signs that guide motorists safely and surely day and night.

Fabrication of professional traffic signs with an automatic vacuum applicator is the method now in use by over seven hundred cities and counties to get better signing at lower cost.

The starting point for savings is refurbishing old signs right in your own shop. You can give your old signs new faces in a matter of minutes in an applicator...and actually, you can switch over to red stop signs for as little as $3.60 per sign.

For additional savings, look at those projects you have wanted to start but, perhaps, put off because you thought they might be too costly. Projects like new reflective street name signs, hazard markers—distinctive trailblazers and guide signs that direct motorists day and night for city parkways or county roads. Faces for these signs can be made to order for you at lower cost than you think. All you have to do is apply the face to your sign blank in your applicator. Takes only five minutes.

For instance, you can reflectorize street or road name signs in a 3′ x 4′ applicator that turns out 10 or more of these 6″ x 24″ signs every five minutes.

Or you can make 8″ x 36″ bridge end markers to reduce the danger of darkness with any bridge hazard in your area—for as little as $1.95 per marker face.

Important, too, is the fact that operating an applicator is so simple you don't need specially trained men to make reflective signs. Production is fast—so you won't need extra people in your sign shop even during the busy spring season. When maintenance crews are idled by weather conditions their time can be more fully utilized by sign making jobs in the shop.

Vacuum applicators are available in a variety of sizes—including this new, table top "Economist" model. Designed for small shops, it produces nine 24″ x 24″ reflectorized signs per hour at low cost.

Your 3M Representative can tell you more about how to get the most out of your vacuum applicator—to put more into your signing program. You can get complete information by writing: 3M Company, Dept. RBM-109, St. Paul 6, Minnesota.

Anyone can operate a vacuum applicator—no special training is needed. You can make signs any time you need them—and give your community better safety with better signing at low cost.

MINNESOTA MINING AND MANUFACTURING COMPANY
...WHERE RESEARCH IS THE KEY TO TOMORROW
3M COMPANY
St. Paul 6, Minnesota

REG. U. S. PAT. OFF.
SCOTCHLITE
BRAND
REFLECTIVE SHEETING
The term "Scotchlite" is a registered trademark of 3M Co.

Beth-Cu-Loy culvert under 43 ft of fill

Poking its nose out from under a 43-ft fill of earth and rock is a 292-ft-long culvert of 8-gage Beth-Cu-Loy corrugated galvanized steel. This 42-in.-diameter culvert rests easy beneath its tremendous burden because Beth-Cu-Loy pipe is flexible, thus tends to distribute the stresses peripherally.

Flexibility also permits corrugated galvanized steel pipe to take the impact and vibration of heavy vehicular traffic. It takes care of changes caused by freezing and shifting soil, and makes grading and alignment easy. Installation is simple and speedy, without need for heavy special equipment.

Beth-Cu-Loy culvert sheets conform to the rigid specs of the AASHO. Rolled from open-hearth steel, these sheets contain copper for added corrosion-resistance. Additional protection comes from a tight, 2-oz coating of Prime Western zinc.

We'll be glad to send you full details about Beth-Cu-Loy culvert sheets, as well as the names of fabricators who form them into pipe. Just call or drop a line to the nearest Bethlehem district office.

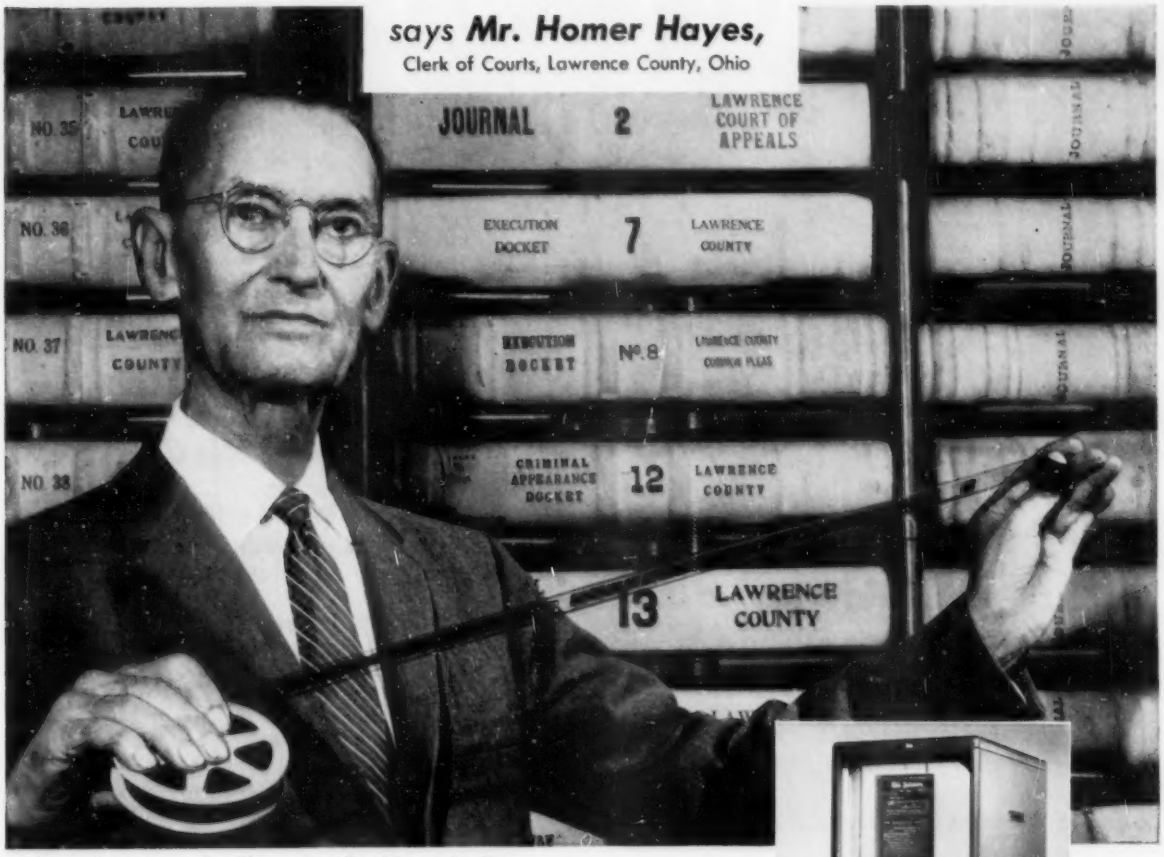
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

"Recordak Microfilming makes bound volumes of court cases as outdated as the horse and buggy!"

says **Mr. Homer Hayes,**
Clerk of Courts, Lawrence County, Ohio


JOURNAL 2 LAWRENCE COURT OF APPEALS
EXECUTION DOCKET 7 LAWRENCE COUNTY
CRIMINAL APPEARANCE DOCKET 12 LAWRENCE COUNTY
13 LAWRENCE COUNTY

Recordak 16mm microfilm copies of petitions, pleadings, and other court items end need for bound volumes.

"Nearly $100 for each volume! That's what it used to cost us to type out records of court cases and have them bound. But no more—with a Recordak Reliant Microfilmer, we preserve the same information on less than $3.50 worth of film.

"We keep more data on just one roll of microfilm than in a 600-page volume . . . and we save nearly $100 in the bargain. Not to mention that taking pictures with our Recordak Microfilmer is a lot faster, easier, and more accurate! As for space savings," adds Mr. Hayes, "once all our older records (dating back to 1815) are microfilmed our files, which now fill 2 rooms, will all fit on less than 150 rolls of film!"

Large or small, your agency can save money, time, and space with Recordak Microfilming. Mail coupon today for further details. No obligation.

"Recordak" is a trademark

Reference is easy with a Recordak Film Reader. Any item can be found in a few seconds

RECORDAK

(Subsidiary of Eastman Kodak Company)

originator of modern microfilming
—now in its 32nd year

MAIL COUPON TODAY

RECORDAK CORPORATION Y-10
415 Madison Avenue, New York 17, N.Y.

Gentlemen: Please send me further details on the use of Recordak Microfilming in government agencies.

Name_____

Title_____

Agency_____

Street_____

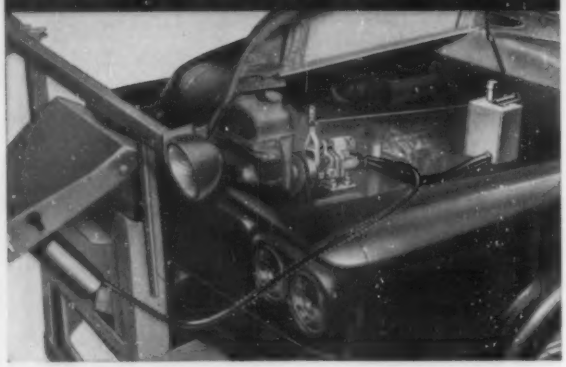
City_____ Zone____ State_____

Cut snow removal costs up to 50%

Gar Wood

SNOWLIFT

HYDRAULIC SNOW PLOW CONTROL



featuring the ALL-NEW, FASTER ACTION

HYDRA-CLUTCH® PUMP

Exclusively from Gar Wood, the Snowlift Kit features the only clutch-type pump available for snow plow control. With the Hydra-Clutch Pump, the pump gears are set in motion only when lifting the plow blade. This means far less wear and longer life for the pump. In addition, this hydraulic system puts no drain on the battery.

Here's the "POWER PLANT" of the New SNOWLIFT

The Hydra-Clutch Pump develops tremendous power... blade can be raised completely in six seconds to avoid open spaces or obstacles. The Snowlift Kit consists of the Hydra-Clutch Pump, cylinder and the complete hydraulic system.

Get the "cost cutting" story on the new Snowlift from your Gar Wood distributor or snow plow dealer.

Wayne, MICHIGAN

Richmond, CALIFORNIA

Gar Wood INDUSTRIES, INC.

Commentary

on

Water and Sewage Treatment

ARE FILTER RATE CONTROLLERS NECESSARY?

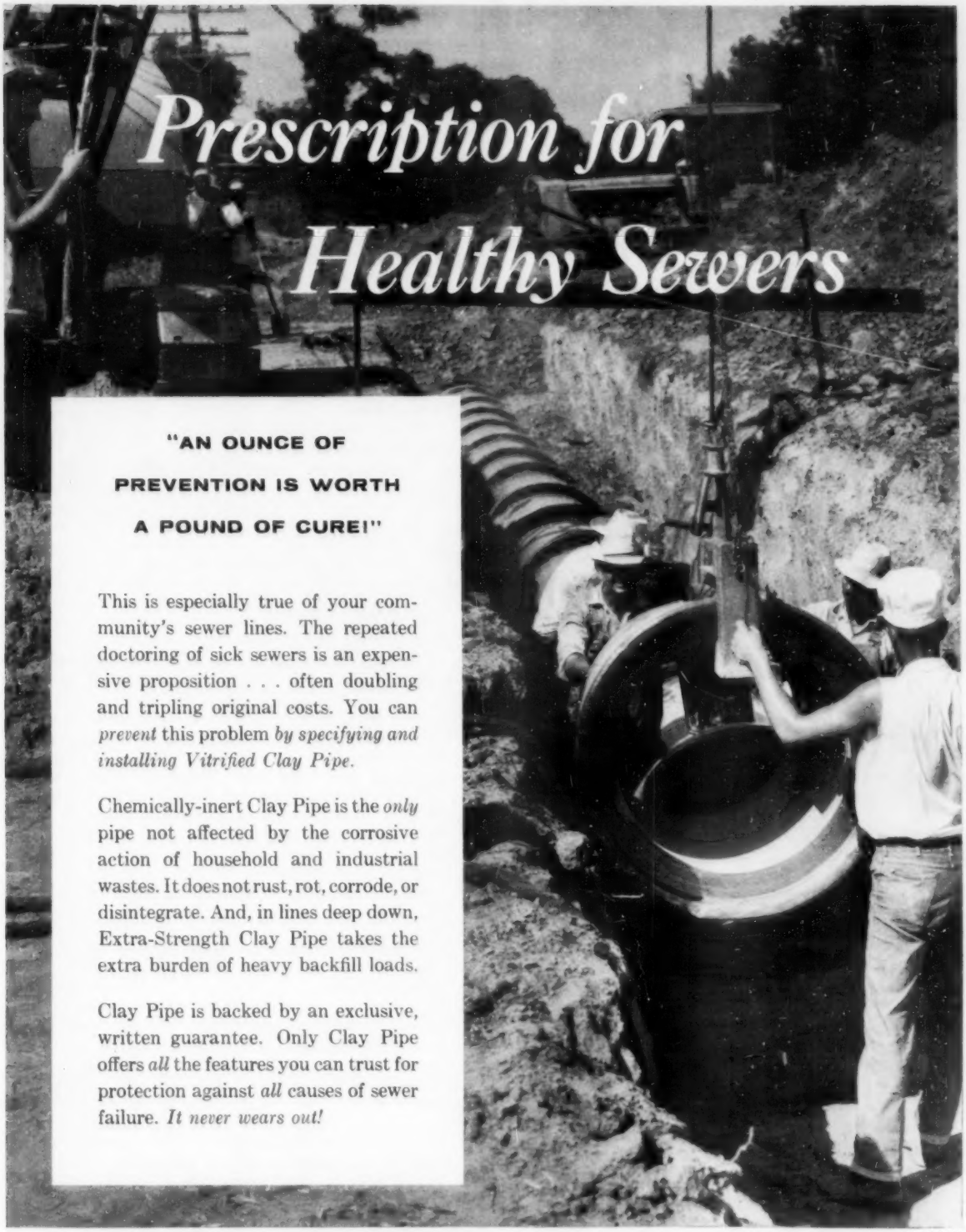
R. S. RANKIN

Consultant, Water and Sewage Treatment

ELIMINATION of rate controllers on rapid sand filters at first glance would seem the height of imprudence, like a boat without a rudder. Yet, it is being done in one new plant and tried out in another. It seems incredible that a filter could function without this time-honored device which has always been considered indispensable from the early days of water filtration. Of course, one would naturally assume the omission would affect the filter performance adversely but strangely any significant difference seems to be in its favor. Can it be that it has taken 50 years to find out that this ingenious piece of equipment is now unnecessary? Judging by current information this seems possible and it may represent further progress in pulling water filtration out of the groove it was in for decades. Before abandoning all rate controllers, however, it is worth reviewing the evidence to see what course to follow.

Hudson, a keen student of the mechanism of filtration and apparently the first to suggest the idea, discusses tests made in 1957 on a plant in the Detroit area in which the controller were disconnected and the filtration rate was changed from fixed to variable, that is, the rate was determined solely by the condition or resistance of the filter media (1). Subsequently, Sawyer discloses that the Wayne County, Mich., plant is designed with rate controllers omitted although space for them is being provided (2). Apparently the tests justified this bold step. Recently Baylis (3) reported on an extended series of comparative tests on filters at the Chicago South District Filtration Plant, operating with and without the benefit of rate controllers. The results are most revealing.

The comparative tests at Chicago included in his report cover a period of 7½ months from mid-October, 1958 through May, 1959. Twenty filters out of a total of 80 were operated on the variable flow



Prescription for Healthy Sewers

"AN OUNCE OF PREVENTION IS WORTH A POUND OF CURE!"

This is especially true of your community's sewer lines. The repeated doctoring of sick sewers is an expensive proposition . . . often doubling and tripling original costs. You can *prevent* this problem *by specifying and installing Vitrified Clay Pipe.*

Chemically-inert Clay Pipe is the *only* pipe not affected by the corrosive action of household and industrial wastes. It does not rust, rot, corrode, or disintegrate. And, in lines deep down, Extra-Strength Clay Pipe takes the extra burden of heavy backfill loads.

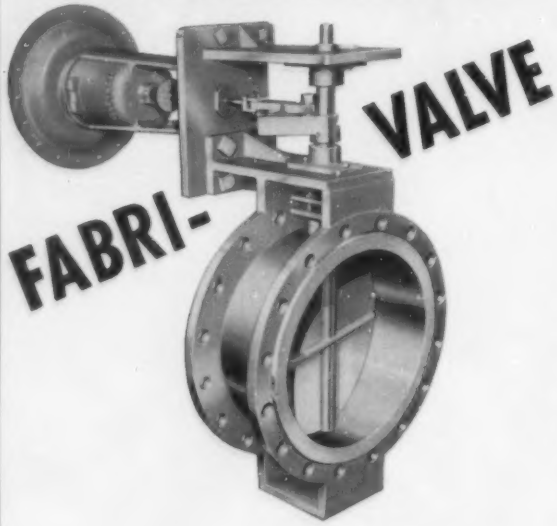
Clay Pipe is backed by an exclusive, written guarantee. Only Clay Pipe offers *all* the features you can trust for protection against *all* causes of sewer failure. *It never wears out!*

C-359-IA

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 783 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia

BUTTERFLY VALVES



- CUSTOM ENGINEERED OR STANDARD AWWA CLASSES
- ANY TYPE OPERATION
- WAFER MODEL AVAILABLE FOR LIMITED SPACE
- RESILIENT RUBBER SEATS

FABRI-VALVE offers many advantages in their butterfly design. Standard designs in sizes up to 24 inches, and custom engineering for applications up to 60 inches. By utilizing either cast or fabricated construction, your valve needs are fulfilled, giving the most efficient, dependable, and economical installation.

FABRI-VALVE TRADE MARK

For more information, call the distributor in your area or write . . .

COMPANY OF AMERICA

2100 N. Albina Avenue, Portland 12, Oregon

FABRI-VALVE DISTRIBUTORS: ASSOCIATED INSTRUMENTATION & CONTROL, LTD., Montreal, Quebec • R. A. KINSMAN, Anaheim, Calif. • CORDES BROTHERS, San Francisco, Calif. • FELKER BROTHERS, Marshfield, Wis. • ZINN INDUSTRIAL SUPPLY CO., Lewiston, Idaho • THOS. W. MACKAY & SON, LTD., Vancouver, B. C. • LEE REDMAN EQUIPMENT CO., Phoenix, Ariz. • SOUTHERN CORP., Charleston, S. C.

FABRI-VALVE AUTHORIZED DEALERS: HAROLD E. INGALLS, Portland Maine • KEM-E-QUIP CO., Niagara Falls, N. Y. • MAY SALES & ENGINEERING CO., Houston, Texas • DOUGLAS ROBBINS & CO., Lockport, Illinois • MARCH CORP., Detroit, Mich.

method, which means that each filter began its "run" at some maximum initial flow rate and continued to operate until the rate dropped to exactly one-half the initial rate. The filter was then taken out of service, washed in the usual manner and put back in operation. Loss of head was disregarded.

Turbidity measurements of the filter effluents, the average of 12 tests daily over the entire 7½ month period, were as follows:

Filters *with* rate controller in operation—0.0032 ppm turbidity.

Filters *without* rate controller in operation—0.0044 ppm turbidity.

During this period over 90% of the tests showed no measurable difference in the turbidity of the effluent of one group of filters compared to the other.

Another interesting comparison is available from this report. For the period from January to May, 1959, inclusive, the average volume of water filtered per run, i.e. between washings, was as follows:

Filters *with* rate controllers in operation—3.28 million gallons.

Filters *without* rate controllers in operation—5.09 million gallons.

Nothing in the report indicates that the 20 filters with inoperative rate controllers were favored in any way compared with the 60 other filters whose rate controllers were functioning in the normal manner. Initial rates of 4 gpm per sq. ft. and terminal rates of one-half with an average of 3 gpm per sq. ft. were in effect for half of one month on the variable flow filter with no apparent ill effect. At other times during the test period average rates of approximately 2.25 gpm per sq. ft. were used.

Commenting on the remarkably low turbidities in the filtered water, which were measured to three decimal places, it is doubtful that many plants have the facilities for such precision. Incidentally, it would be interesting to know how many water works with surface supplies are delivering a water with a turbidity of only 1/200 ppm. It has been said that the average consumer cannot distinguish turbidities of 1.0 ppm except in appreciable depth, while the present U. S. Public Health standard for drinking water is 10 ppm or less. By any standard the Chicago product is exceptional. However, at the Chicago plant any turbidity in the filtered water is deposited in the filtered reservoir and eventually requires removal.

Judging from these results at Chicago and the designs for the Wayne County Plant, filter effluent rate controllers are unnecessary. This might be attributable to local conditions and should require consideration of several factors before general adoption. The Chicago plant is one of the largest in the world with a nominal capacity of 420 MGD. It has a highly skilled technical staff and unsurpassed testing facilities. The Wayne County plant will have a capacity of 160 MGD, large enough to assure facilities similar to Chicago. Both of these plants are on the Great Lakes with not dissimilar raw water characteristics. It is reasonable to expect that what would work at one plant would work at the other.

The question of application to filter plants in general can be determined only by experience. Every filter unit requires a measuring device with instruments and a shut-off valve in the effluent so that it can be taken out of service. Possibly an orifice plate can serve as a measuring device replacing the venturi tube now universally used. However, the reason for using a venturi tube goes back to the need

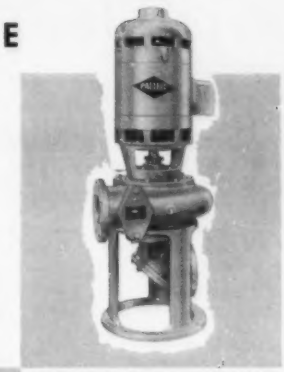
A TYPE FOR EVERY SERVICE... PACIFIC

Non-Clog SEWAGE PUMPS

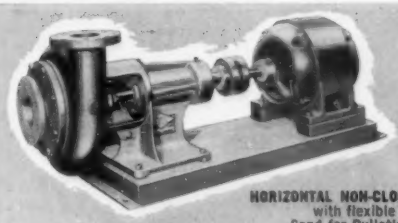
RUGGED - DEPENDABLE

DRY PIT - WET PIT
SUBMERSIBLE
HORIZONTAL
CHOICE OF IMPELLERS

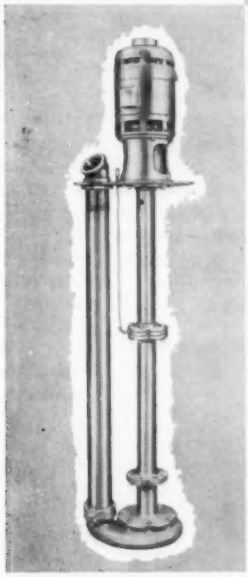
PACIFIC NON-CLOG PUMP with motor, motor support bracket, suction elbow and stand. Send for Bulletin 1850.5.



VERTICAL UNITYPE DRY PIT MODEL. Motor shaft connects directly to impeller and mounts on volute. Send for Bulletin 1850.5.



HORIZONTAL NON-CLOG MODEL with flexible coupling. Send for Bulletin 1850.5.

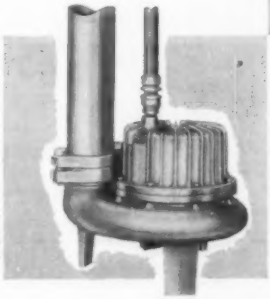


Outstanding performance and long trouble-free service from every type. Pacific Non-Clog Sewage Pumps combine all desirable design features that assure efficient, economical and dependable operation and service.

Order now. ALL TYPES AVAILABLE FOR IMMEDIATE SHIPMENT.

NON-CLOG DRY PIT pump with double suction elbow and stand. Send for Bulletin 1850.5.

NON-CLOG WET PIT with cover. Single unit. Duplex models with alternating controls available. Send for Bulletin 1850.2.



SUBMERSIBLE NON-CLOG
A complete unit ready to install includes pump, motor, automatic controls and cable to control panel. Send for Bulletin 1850.5.

PACIFIC PACIFIC PUMPING CO.
Established 1907
Manufacturers and Distributors of Pumps for Every Service
MAIN OFFICE AND FACTORY: 9301 San Leandro St., Oakland 3, Calif.
OAKLAND, Calif. · Portland, Ore. · Seattle, Wash. · Los Angeles, Calif. · Dallas, Texas

in Swimming Pools it costs no more for the very best Protection!

Josam **SWIMMING POOL EQUIPMENT for WATER LEVEL DECK POOLS**

The Water Level Deck Type Pool is a more sanitary, safer and more usable pool for all age groups, in addition to being a more economical pool.

The deck level construction permits filling the pool to a level where the bather can roll out of the water to the promenade deck, at any point, in the easy "turtle type" method, without depending on ladders, steps, ramps or other means. This method makes the Water Level Deck Type Pool very advantageous for the instruction of children, paraplegics and other handicapped bathers.

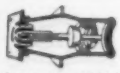
Scum is washed over the coping and out of the pool to accessible drains. The water level which is 1" below the top of the coping, eliminates hard-to-drain scum gutters above the water line and also effects a saving of cost for formed tile gutters and from 5" to 10" of excavation and concrete walls.

Send coupon below for Manual SP-6, the "authority" on swimming pool circulation and drainage. In it you will find typical plans and layouts of pools, with complete descriptions of supply fittings, gutter drains, overflows, outlets, vacuum connections, hair and sediment interceptors and other necessary fittings to meet every pool requirement.

Series No. 0291-B Deck Trench grate

Series No. 0297-B Skimmer grill and access gate

Series No. 0298 Skimmer Fittings with flow control



Series No. 0730-B Balanceze Supply Fitting

Series No. 0380 Main outlet drain

Series No. 0770-B Vacuum Fitting

Josam

JOSAM MANUFACTURING CO.

General Offices and Manufacturing Division
Michigan City, Indiana

JOSAM MANUFACTURING COMPANY
Dept. PW-10, Michigan City, Indiana
Please send free copy of Manual SP-6

Name.....
Firm.....
Address.....
City.....Zone.....State.....

for conserving head where every inch was important and it becomes a question of hydraulics and economics whether the saving in head with a venturi instead of an orifice is justified. Recent developments in venturi tube designs have resulted in reduction in length but possibly at the expense of efficiency of head recovery. In any case, the possible savings in cost with the omission of the controller will be only that of the regulating device.

Baylis points out that any plant operator can try out for himself the variable flow idea by simply setting the rate control valve at a wide open position and observing results. This seems an excellent idea and one which will aid in determining whether omission is generally applicable on all types of waters, whether colored or turbid, or hard or soft, or whether pretreatment conditions have any influence.

General physical features of rapid sand filters are still remarkably similar to the first installation in 1902 at Little Falls, N. J. However, as the technology of water treatment advances, some of the long established rules and customs occasionally have been revised or abandoned. Rating the capacity of a filter on the old established unit of 2 gpm per sq. ft. is gradually yielding to higher values and the justification for an increase is quite apparent. Better pretreatment with mechanical flocculation ahead of filtration now removes at least 90% of the impurities. Agitation of the filter bed during washing by air or mechanical means, once considered so essential, has long since been found unnecessary and in its place has come the more effective surface wash. The filter-to-waste valve, once a standard requirement on the assumption that filters might be washed with unfiltered water, has been eliminated permitting some simplification of the complex piping. Butterfly control valves in place of the former standard gate type now save on the limited space. Even rate controllers are now built with tight closing regulating valves making unnecessary the additional shut-off-valve.

Thus major changes are not without precedent although frequently not without resistance. Now is a good time to begin an evaluation of rate controllers to determine whether their omission brings unanticipated problems, particularly in the smaller plants. Why it should take 50 years to discover that they may be unnecessary is hard to believe but only by extensive tests in many plants of all sizes can the complete answer be learned. Meanwhile, to be on the safe conservative side, it seems advisable to continue to design rate controllers into new plants for the average water works.

References

1) Herbert E. Hudson, Jr. Factors Affecting Filtration Rates, *Jrnl. AWWA*, Vol. 50, 1958, Pg. 271
2) Alfred W. Sawyer, Functional Design of the Wayne County Plant, *Jrnl. AWWA*, Vol. 51, 1959, Pg. 761
3) John R. Baylis, Variable Rate Filtration, *Pure Water*, Bureau of Water, Chicago, Ill. Vol. XI, May 1959, Pg. 86

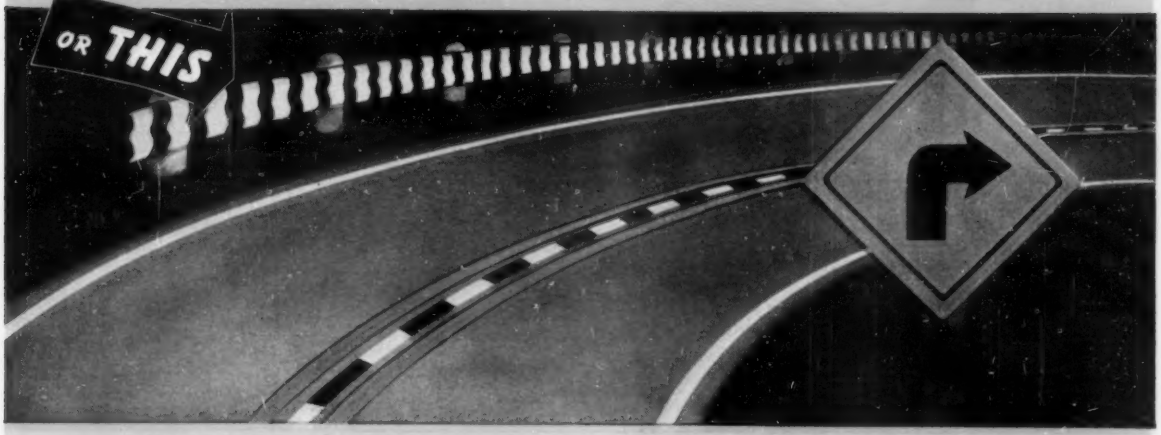
• • •

Fixtures for School Lavatories and Toilets

A special report by the School Planning Laboratory of the Stanford University School of Education covers the pupil-to-fixture ratio. Following is a summary of the recommendation:

Toilets (kindergarten through sixth grade)—boys, 1:20 (minimum), 1:40 (maximum); girls, 1:15 (minimum) 1:35 (maximum); grades seven through 12th—boys, 1:30 (minimum), 1:50 (maximum); girls, 1:20 (minimum), 1:40 (maximum).

DO YOUR TRAFFIC SIGNS LOOK LIKE...



FLEX-O-LITE

LEAD-FREE REFLECTIVE GLASS BEADS COULD MEAN THE DIFFERENCE

Signs employing the finest reflective materials are adversely affected in a number of ways, such as by moisture, thermal changes and dirt . . . as well as acts of vandalism, accidental breakage and normal wear and tear. Further, the sulphides in industrial fumes attack glass beads containing lead, causing them to turn dark, with a consequent loss of their reflectiveness and visibility. Maintaining adequate visibility through fair weather and foul for maximum safety is a *must*. To ignore this fact is bargaining with lives. So, it is just common sense to buy lead-free beads that won't turn dark. That's why street and highway engineers specify Flex-O-Lite Lead-Free Reflective Glass Beads —with full confidence in their maximum brilliance and lasting reflectivity throughout a longer life. Specify the beads proved best by test. Insist on Flex-O-Lite Lead-Free Reflective Glass Beads. Write for free, informative brochure.

- **#831 REFLECTIVE GLASS BEADS**—Best for white and yellow signs. Meet and exceed all test requirements . . . microscopic, acid, sodium sulphide, spherical content, gradation.
- **FREE-FLOWING REFLECTIVE GLASS BEADS**—Won't agglomerate. Contain no injurious waxes, oils or resins. Offer perfect adhesion to any suitable traffic bead binder. Economical.
- **TYPE H SAFETY SPHERES**—Approximately fifteen times brighter than standard highway beads. For reflectorizing guard rails, curves, bridge abutments, safety islands, etc. Offer maximum reflectivity at lowest cost.
- **FLEX-O-LITE FREE-FLOWING TRAFFIC LINE BEAD DISPENSER**—New, simplified. Affords years of trouble-free operation. Ideal for municipal and highway use. Attaches to any traffic line paint machine. Satisfaction guaranteed.
- Ask about our Sign Bead Applicator.

FLEX-O-LITE

FLEX-O-LITE MFG. CORPORATION

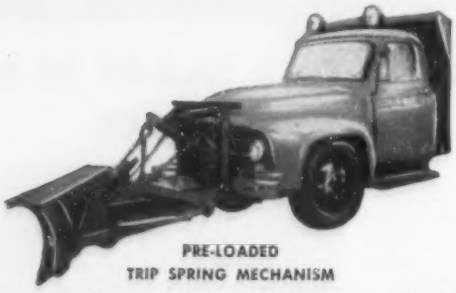
8301 FLEX-O-LITE DRIVE • P. O. BOX 3066 (AFFTON BRANCH) • ST. LOUIS 23, MO.

Versatile Reversible!

The NEW **FRINK**

TRIP-BLADE SNO-PLOW
for all-purpose snow removal

Here's the plow designed to cope with almost every snow removal problem. The new Frink Reversible Sno-Plow with Trip Blade plows left or right for in-city maneuverability . . . bulldozes straight ahead for clearing intersections, bridges, lanes, parking lots, airport ramps and wide sidewalks. Power hydraulic mechanism, controlled by cab lever, reverses plow while raised or on ground, even while plowing. (Models with manual reverse by single lock pin also available.) Curved, panelled moldboard with deflector makes the Reversible lighter and safer to use at all speeds.



PRE-LOADED
TRIP SPRING MECHANISM

Dual-purpose springs with special linkage to moldboard create "free-flowing" action that follows road contour, produces smooth tripping over obstructions and quick, cushioned rebound without chatter. Cutting edge and plow shoes are replaceable; scuff shoes bolted outside moldboard protect against curbs, side obstructions.

Other dependable Frink Sno-Plows (V-Type, One-Way and Roll-Over) are interchangeable on trucks with attachments for the Reversible.

For Snow Plow Know-How It Pays to Think of FRINK SNO-PLOWS

FRINK SNO-PLOWS, INC., CLAYTON, N. Y.
Eastern Steel Products, Ltd., Preston, Ontario-Canada

Urinals (kindergarten through sixth grade)—boys, 1:15 (minimum), 1:35 (maximum), grades seven through twelve, 1:15 (minimum), 1:35 (maximum).

Lavatories (kindergarten through sixth grade)—boys, 1:25 (minimum), 1:45 (maximum); girls, the same; grades seven through twelve—boys, 1:30 (minimum), 1:50 (maximum); girls, the same.

Drinking fountains (kindergarten through sixth grade)—1:30 (minimum), 1:50 (maximum); grades seven through twelve, 1:40 (minimum), 1:60 (maximum). There should be at least two drinking fountains per floor in these upper grades, the survey points out. Showers for the school physical education program, grades seven through twelve only, should be installed at a ratio of one showerhead for every three students using the facilities.

Copies of the report are available at $2.00 apiece through the School Planning Laboratory, School of Education, Stanford University, Stanford, California.

Fluorescent Safety Paints Used on Sanitation Trucks

The Chicago Department of Sanitation is using Hi-Viz fluorescent safety paint on its trucks. These safety paints are available in red-orange, yellow-orange, red, pink, cerise-red, gold-yellow, lemon-yellow and green. Their high visibility factor recommends them to many municipal uses such as on fire hydrants; litter baskets; alarm boxes; police, fire and other emergency vehicles; traffic control signs and devices; highway stripings; barricades; signal paddles and flags; radiation protection shelters; tollway and expressway markers, etc. The paints maintain their brilliant colors for periods up to 21 months or more, depending on method of application and geographical location. They may be applied by brush, roller or spray equipment and are also available in aerosol containers.

Public Works Activities in Columbia, South Carolina

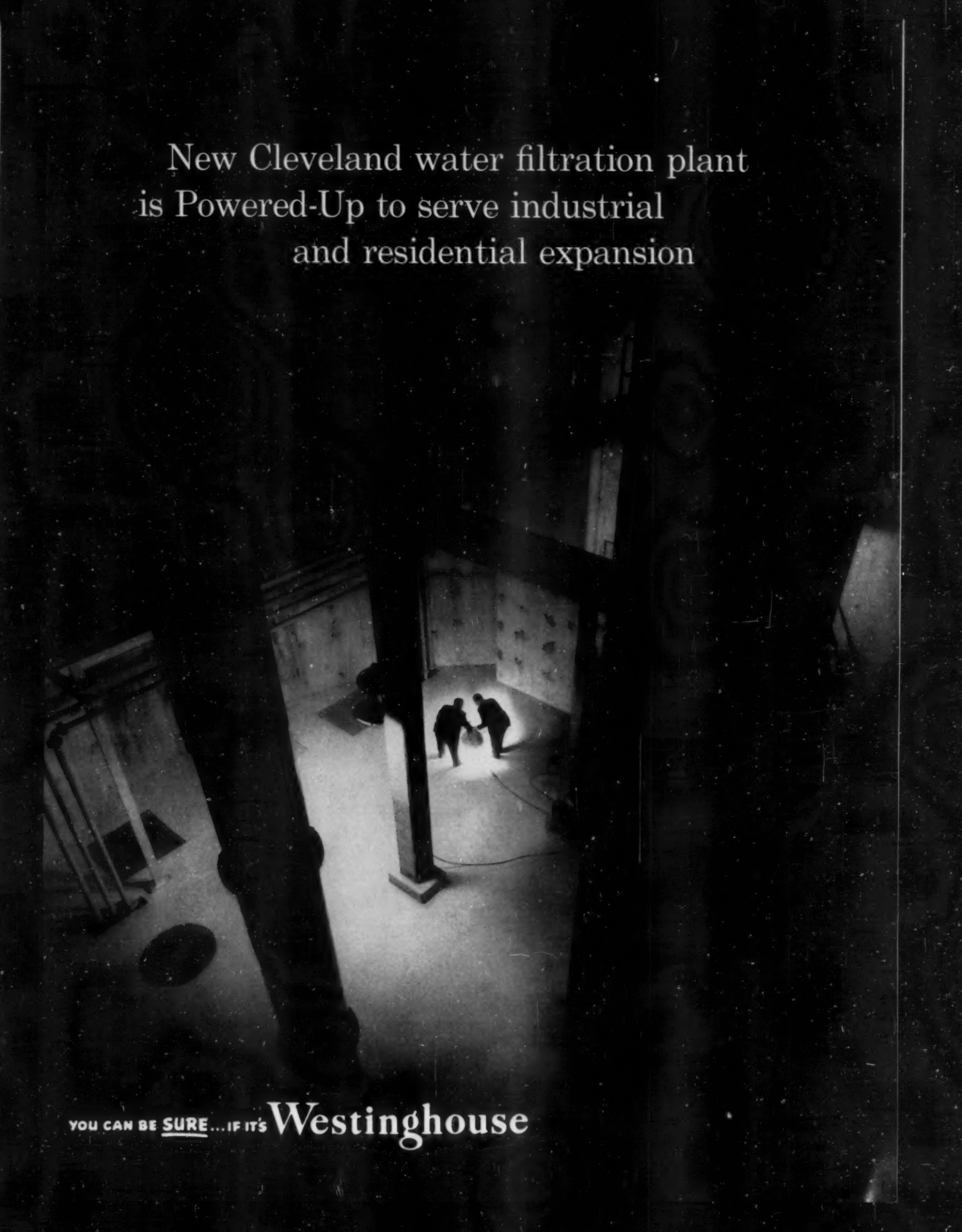
During the past year in Columbia, S. C., 72,123 ft. of water mains were laid, 624 water services connected and 918 meters and 333 lines repaired; the water plant filtered 5.260 mg, 200 million more than last year.

Other installations during the year included 10,562 ft. of storm drain, 42 hydrants, 15,922 ft. of sewers, 159 street lights, 2 traffic signals, 5 alarm boxes and 8 radio sets.

Also recorded were collections of 13,980 tons of garbage, 12,810 loads of trash, cleaning of 17,952 miles of streets and 18,570 ft. of sewers and drains and painting of 660,959 ft. of traffic lines. The Tree Div. planted 500 new trees, trimmed 2,644 and hauled 1,749 loads of logs and brush.

Breaks in Water Mains and Cost of Repairs in Honolulu

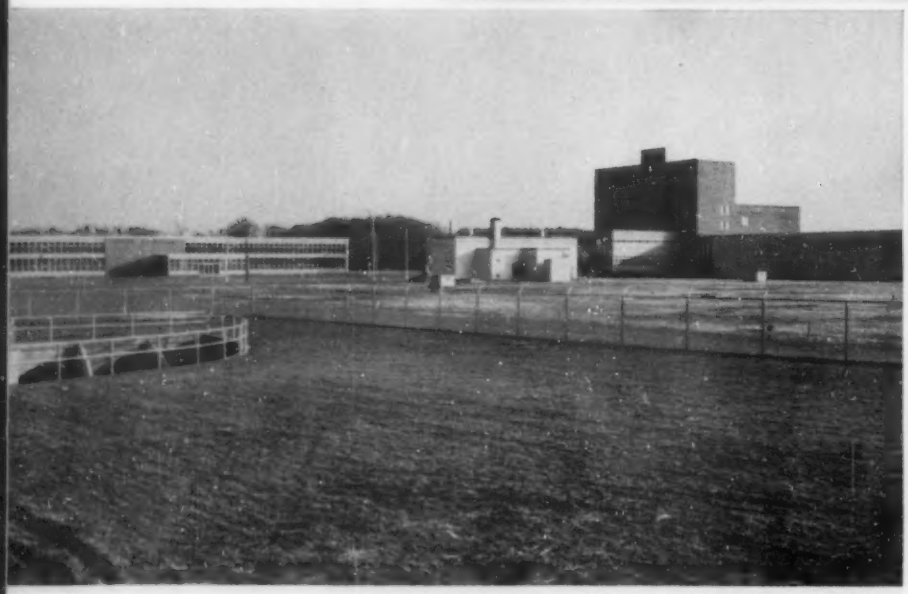
There were 503.3 miles of water pipe in use in the Honolulu water system as of July 1, 1958, of which 37.52 miles were less than 4 ins. in size. The number of breaks in 4-in. and larger pipes averaged 0.12 per mile (compared to 0.20 the preceding year) and the cost of repairs per mile for 4-in. and larger averaged $32.50. For 6-in. repairs, the average per job cost of repairs was $218.69; for 8-in. it was $305.44; for 12-inch $463.28; and one 16-in. break cost $578.46 to repair.


New Cleveland water filtration plant
is Powered-Up to serve industrial
and residential expansion
YOU CAN BE SURE... IF IT'S Westinghouse

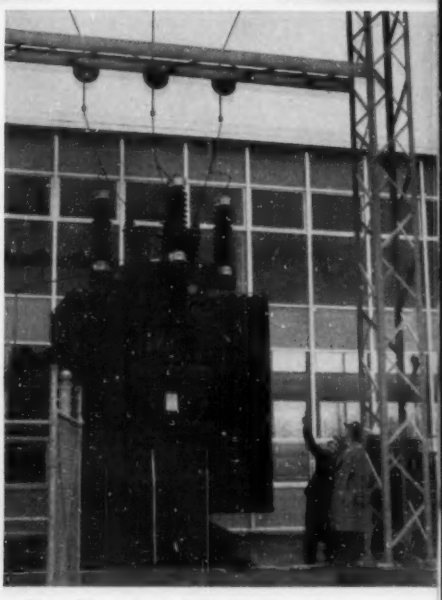
Cover photo:
View of raw water pump suction wells illuminated by Westinghouse VEK-16 floodlighting.

Project group discussing layout of Crown Filtration Plant includes J. E. Hrovat, Vice President of Engineering, Doan Electric Co., Electrical Contractors; E. E. Croushore, Westinghouse Construction Sales Engineer; L. O. Meyer, Branch Sales Manager, WESCO, Cleveland; Dan Kasych, Chief Engineman, Pump Building; G. L. Baughman, Chief Electrical Engineer, Havens and Emerson, Consulting Engineers; S. C. Simmermacher, Chief Mechanical Engineer, City of Cleveland; M. B. Trimble, Westinghouse Construction Sales Engineer; E. S. Goulder, President, Doan Electric Co.; and H. M. Stafford, Salesman, WESCO, Cleveland.

J-94123-R2



Over-all view of Crown Filtration Plant, Cleveland, Ohio. Pump building is at left and the filter building at right. Westinghouse OV-20 street lighting was provided for plant entrances and roadways.



Dan Kasych and E. E. Croushore examine one of the two Westinghouse 5000-kva power transformers which step incoming 34.5-kv service down to 4160 v for main pump drives.

Westinghouse system provides for 100% electrical load increase in new water pumping station

The new Crown Filtration Plant was designed to meet the growing need for water supply in the westerly suburbs of Cleveland, Ohio, and, as an important part of that planned expansion, the Westinghouse electrical system presently installed provides for 100% load increase without adding to the system.

The pumping station-filtration plant is located on a 55-acre site and is the newest addition to the city's expanding water supply system. Construction was started in 1953 and completed in 1958, and represents nearly a $20,000,000 investment. Present plant capacity is 50 mgd; but, because of anticipated future requirements, the plant has space and provision for additional equipment to provide capacity of 100 mgd.

Raw water is obtained through a crib 2½ miles offshore in Lake Erie. The water from the crib is carried through a connecting tunnel to a raw water well, where its handling is taken over by submerged raw water pumps. Treatment and flow of the water from this point through the filtration plant are automatic and exactly controlled, leading finally to a 15-million-gallon filtered water reservoir located in the southwest corner of the plant area. Six service pumps deliver the water from the reservoir to both the low service zone and the first high service zone supplied by the Crown plant.

The major electrical elements supplied by Westinghouse to Power-Up this filtration operation include:

Two 5000-kva power transformers—to step utility service from 34.5 down to 4.16 kv.

Main metal-clad switchgear—to control and distribute power to motor starters (for L.S.) and provide for starting of H.S. motors (1750 hp).

Dry-type power center—to provide 480-v service to plant auxiliaries.

Westinghouse lighting throughout the plant area, including fluorescent, incandescent, street lighting and floodlighting.

In addition, Westinghouse supplied the many panelboards required in the plant's operation.

The planned Powering-Up of the Crown Filtration Plant means it can meet all foreseeable future requirements with a minimum of modification. Additional water handling and treating facilities can be installed in areas already provided for them. And all such additional equipment can be operated without adding to the existing electrical distribution system.

Cleveland now has surplus water capacity in its plants, and is in an enviable position with an almost unlimited supply of good Lake Erie water. It is ready and willing to construct additional facilities to process and deliver this water whenever the need for a greater supply for new industry is indicated.

(*contd.*)

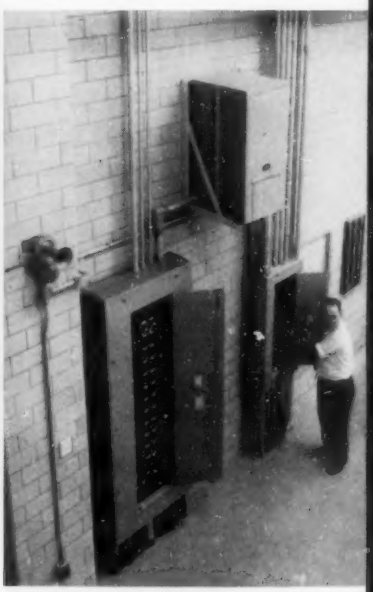
YOU CAN BE SURE...IF IT'S **Westinghouse**

J-94123-R3

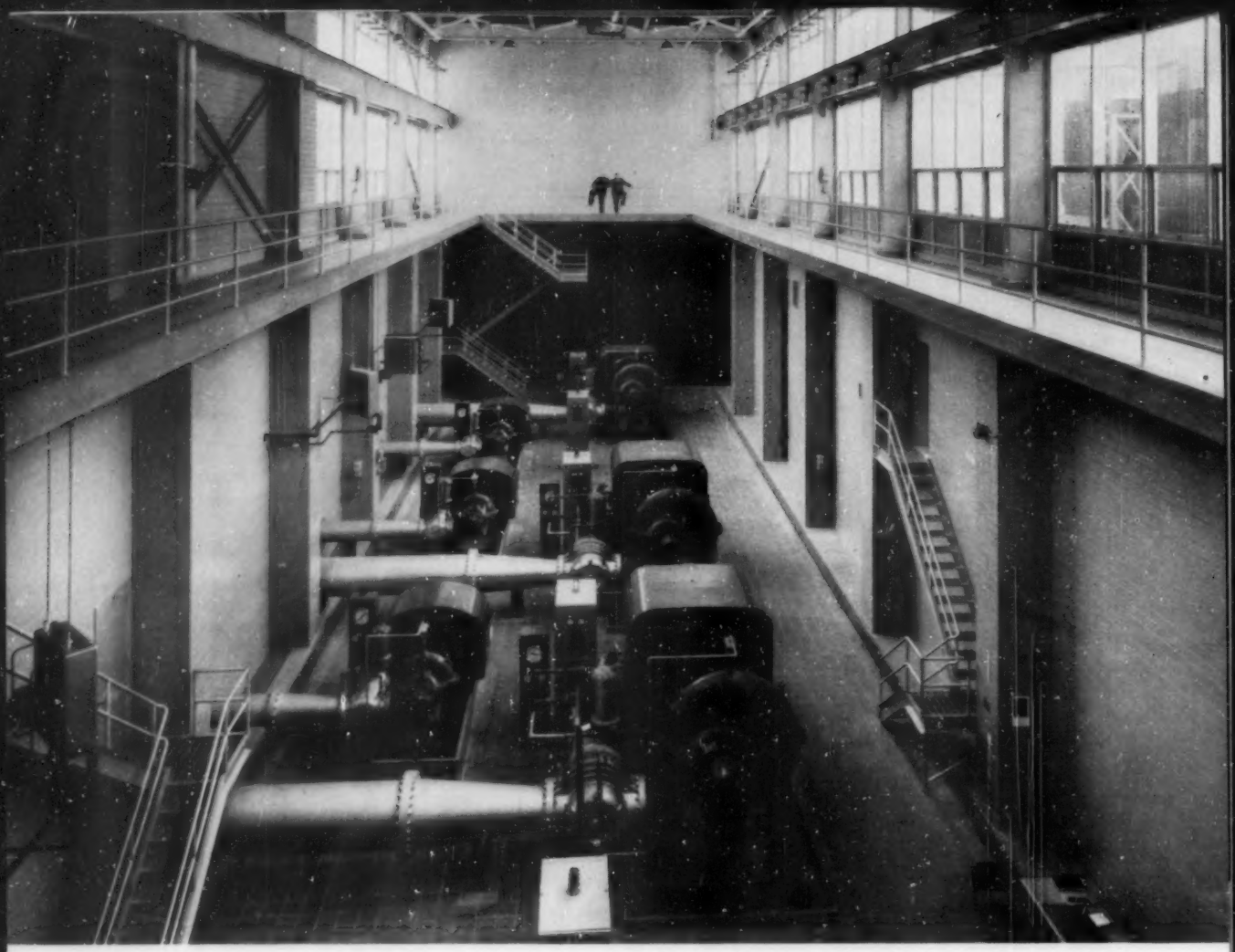
View in main switchgear room with G. L. Baughman, M. B. Trimble and S. C. Simmermacher examining Westinghouse metal-clad switchgear. Lineup at right contains main incoming line breakers, bus tie breaker, reactor starters for high service pump motors, and feeder breakers for power center and low service pump motor starters. Five-kv bus duct overhead provides connections from metal-clad switchgear to Ampgard* high-voltage fused starters at left.

*Trade-Mark

Dan Kasych inspects switchgear room. Westinghouse 225-kva power center utilizes dry-type transformers and DB low-voltage air circuit breakers to supply power panels throughout pump building. Room lighting is Westinghouse 2 SPC-75 slimline fluorescent luminaires.



Westinghouse CDP power distribution panelboard and wall-mounted 37.5-kva dry-type transformer feeding NLAB lighting panelboard.



Section of main pump floor showing the three 25-mgd first high service pumps and three 8-mgd low service pumps which are presently installed. Metal-clad switchgear cubicles and Ampgard high-voltage starters for these and two additional future pumps of each rating are installed in the main switchgear room. High bay mercury-vapor lighting is provided by Westinghouse Millite® luminaires.

View in filter building showing row of clarified water filter beds. Under average flow conditions, the 12 filters in the plant will pass a total of 50 mgd. Lighting is supplied by Westinghouse VEK-16 floodlights.

(contd.)

Electrical system provides for 100% load increase

Powering-Up electrically for future growth can mean important benefits and savings for you. For further information, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94123-R4

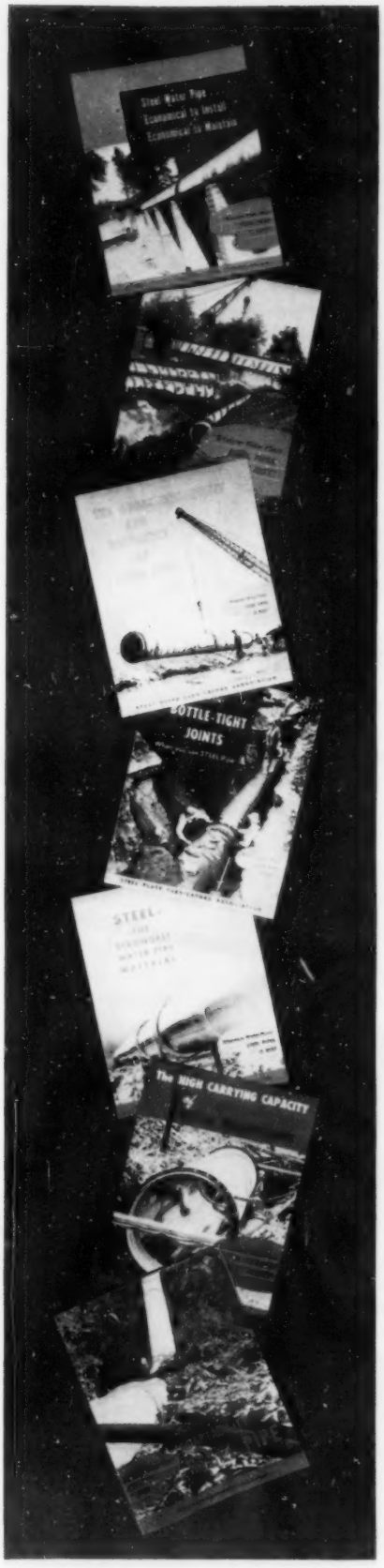
OWNER: City of Cleveland, Ohio
CONSULTING ENGINEER: Havens and Emerson, Cleveland, Ohio
CONSULTING ARCHITECT: Small-Smith-Reeb and Draz, Cleveland, Ohio
GENERAL CONTRACTOR: The Hunkin-Conkey Construction Co., Cleveland, Ohio
ELECTRICAL CONTRACTOR: Doan Electric Co., Cleveland, Ohio
WESTINGHOUSE DISTRIBUTOR: Westinghouse Electric Supply Co., Cleveland, Ohio

Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV FRIDAYS



These FREE Booklets

tell how STEEL PIPE meets the 7 essential requirements for a water pipe line

1. Outstanding strength
2. Extreme durability and long life
3. Economy of installation and maintenance
4. High carrying capacity
5. Ductility and adaptability
6. Great reliability and resiliency
7. Bottle-tight joints

Get your free copy of any of these booklets or the entire set. Write:

STEEL PLATE FABRICATORS ASSOCIATION
105 West Madison Street
Chicago 2, Illinois

STEEL PLATE FABRICATORS ASSOCIATION — FOUNDED 1933

STEEL PLATE FABRICATORS ASSOCIATION
105 West Madison Street • Chicago 2, Illinois

☐ Please send entire set
☐ Please send brochure numbers _____

Name _____ Title _____
Organization _____
Address _____
City _____ State _____
(PLEASE TYPE OR PRINT)

James N. Cole, Highway Superintendent, Smyrna, N. Y.: "We use our No. 977 to build roads, knock down trees, dig ditches, shovel snow and a host of other jobs as they come up. Not only is it versatile, but it really produces."

No. 977 "REALLY PRODUCES"

High production and versatility. This combination of doing many jobs and doing them well makes the Caterpillar No. 977 Traxcavator one of the most economical machines tax dollars can buy.

For this machine is designed to give you peak production. Lift and tilt levers are closely spaced for one-hand operation. With float and lock mechanism, operators can release levers while the bucket is in motion. An automatic positioner stops the bucket at dumping height and returns it to the desired digging angle. And the bucket can be tilted backward 40 degrees at ground level to pry a full load on every pass.

"That pry out action of the bucket enables us to dig rock and get a bucketful every time," agrees Mr. Cole.

The instant response of controls provides excellent maneuverability, particularly in close quarters. Now even quicker cycle times are possible with the exclusive Caterpillar side dump bucket. It confines maneuvering to a forward-reverse movement.

"And," continues Mr. Cole, "the power boosted clutches make the operator's job easy because of the fast response."

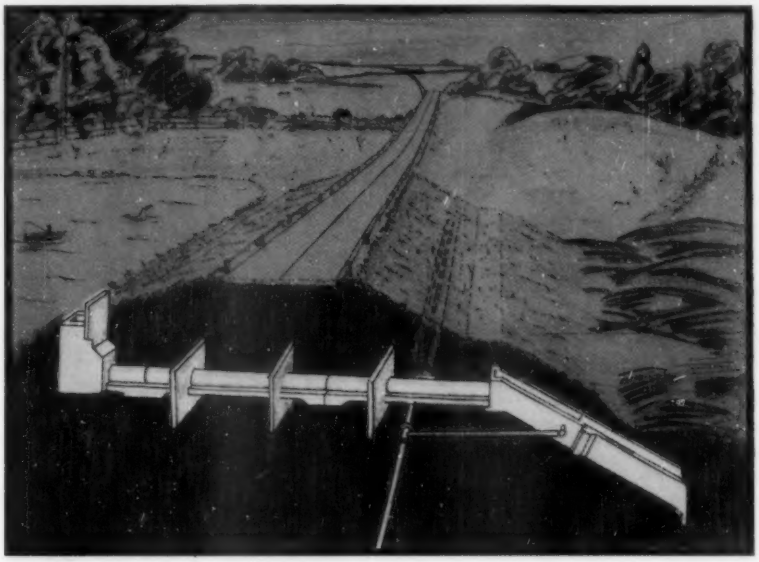
Here's a machine that pays off big. And there's one to fit your exact requirements—the No. 933 with a 1⅛ cu. yd. bucket, the No. 955 rated at 1½ cu. yd. and the No. 977, 2¼ cu. yd. size. Ask your local Caterpillar Dealer for up-to-date facts on Traxcavators. Better yet, challenge him to demonstrate one of these machines on your next job. You name the date, and he'll be there.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES



● CUT-A-WAY view of drop inlet with chute spillway passing under a highway. The pipe is of reinforced concrete, laid in a concrete cradle. Three anti-seep or cutoff collars are spaced 24 ft. apart. Pond at left has capacity of 83 acre-ft. which will be drained in about 14 hours.

EROSION CONTROL DAMS REPLACE OLD WOODEN BRIDGES

CARL A. ELSEA,
Hydraulic Engineer,
Soil Conservation Service,
Sioux City, Iowa

WHEN THE Flood Prevention Program was started on the Little Sioux River in northwest Iowa in 1946, people expected less flood water on bottom lands, increased crop production and less land destruction. What they didn't expect, was a tremendous saving in county road and bridge expense.

In Woodbury County alone the County Board of Supervisors report they are saving the taxpayers $50,000 a year formerly spent in maintaining road crossings over large gullies. They are doing it by replacing old wooden bridges with modern concrete erosion control structures.

The saving in lumber is a typical illustration. In 1954, according to Clair Davis, Woodbury County Engineer, 21 carloads of lumber were purchased for bridge maintenance. In 1958, only 2 carloads were needed.

Bridges over the gullies in the deep loess soils of the Little Sioux Watershed are often 100 feet long. The banks and bottoms of the gullies are very unstable. They get deeper and wider with each heavy rain, making it necessary to lengthen or replace the bridges every few years.

Counties within the Little Sioux project now enter into an agreement with the Soil Conservation Districts and the U.S. Soil Conservation Service, making it possible for all agencies concerned to cooperate in controlling the large gullies that are so common to this area. Erosion control structures that replace bridges on public roads are an integral part of a sub-watershed project of the Little Sioux River Basin. They are developed and financed by the Soil Conservation Service and County as authorized by the Flood Control Act of 1944, Public Law No. 534, 78th Congress. The County or State pays for resurfacing the road and half the cost of the earthwork. Structures outside the sub-watersheds are financed entirely by the County or by the State Highway Commission.

Two types of concrete structures are used to replace the bridges. The topography of the land above the proposed site usually determines which of these two types will be used. If there is adequate silt and water storage available, a floodwater detention type structure is used. This type of structure detains water above a road fill and allows it to drain out slowly after a storm. The volume of the storage area must be large enough to provide for a 50-year estimated yield of silt from the watershed above and for a certain amount of temporary water storage. In this area this type structure is designed for a storm that may occur once in 100 years, which in this case is 4.8 in. of rainfall in a 6-hour period. The run-off resulting from this size storm is 2 in. or less, depending upon the size and shape of the watershed, the cropping system, land use and resulting vegetative cover, and the area that is level terraced. The silt yield also depends on these same features.

This type of detention structure in the upper reaches of a watershed allows county engineers to design structures below to handle only a small part of the previous peak flow. All water detained subtracts

from damaging floodwater on the bottom lands below.

A typical example of a detention type concrete structure is the 24-in. pipe drop inlet structure that replaced a bridge in the Lum Hollow sub-watershed, 4 miles northwest of Smithland, Iowa. The drainage area is 473 acres. The total runoff during a 100-year storm is 101 acre feet. The peak flow is 885 cfs. The peak outflow is 73 cfs. Near the end of the storm there are 83 acre feet of temporary storage. Maximum stage above crest of this inlet is 9.6 ft. Freeboard at this stage is 2.4 ft. This temporary storage will drain out over a period of approximately 14 hours. The estimated 50-year silt yield is 51 acre feet.

The structure itself consists of three parts: 1) The drop inlet is a reinforced concrete box 3 ft. x 3 ft. x 4 ft. deep. It has an anti-swirl wall on the edge next to the earth fill. The purpose of this type drop inlet is to insure that enough water enters the pipe to make it flow full with a head of 1.4 ft. above the inlet. The crest is at elevation 1263.0 which is the top of the 51-acre-foot sediment pool. 2) The conduit or pipe is 156 lineal ft., 24-in. reinforced concrete pipe, in 6-ft. lengths fitted together by the tongue and groove method. It is built into the lower half of the box inlet and extends down on an angle to the outlet near the downstream toe of the earth fill. The pipe is laid in a concrete cradle 3 ft. 7 in. wide and 1 ft. 7½ in. deep.

There are three concrete anti-seep collars spaced 24 ft. apart along the upper 96 ft. of the conduit to prevent seepage along the outside. These collars are 12½ ft. wide and 8½ ft. high. They are poured around the conduit and the joint is made water tight. 3) The outlet is a small reinforced concrete chute. The channel is 2 ft. wide and 3 ft. deep. It extends from the pipe outlet down on a 3:1 slope to 4 ft. below the gully bottom. This chute protects the toe of the fill from the undercutting if the gully gets deeper. The pipe outlet is 8.22 ft. above the gully bottom to provide a free outlet if the gully below silts up or is partially filled by the land owner. The inlet elevation is 1263 ft. The outlet of the chute is 1231, a total drop through the structure of 32 ft.

The earth fill that replaced the old bridge has a top width of 24 ft. It is constructed on a 3:1 slope upstream and 2½:1 slope downstream to the end of the conduit, then on a 3:1 slope along the chute outlet.

● **PIPE IS laid and forms are in place for construction of chute section to dissipate energy of runoff water. This project was constructed in Woodbury Co., Iowa.**

There is an 8-ft. wide berm on the upstream slope at the box inlet and an 8-ft. berm on the downstream slope near the pipe outlet. There are 37,660 cu. yds. of compacted soil in the fill.

The toe drainage system consists of 62 lin. ft. of 6-in. perforated CMP placed across the gully 85 ft. upstream from the toe of the fill at elevation 1237.57. This pipe is laid in a 3½-ft. x 3½-ft. trench filled with pit run sand and gravel. This trench acts as a drainage collector. The outlet of this drain is a non-perforated CMP that outlets into the side wall of the chute at elevation 1236.50. The purpose of this drain is to intercept seepage through the dam and protect the toe of the fill from erosion.

The contract cost of a structure built in 1958 is shown in Table 1.

Table I—Cost of a Structure Built in 1958

37,660 cy compacted fill	@ 17¢	$6,402
3,360 cy excavation	@ 50¢	1,680
42.4 cy rein. conc.	@ $45	1,908
1,364 lbs. rein. steel	@ 14¢	191
156 ft. 24" conc. pipe	@ $6.50	1,014
62 ft. 6" perf. CMP	@ $5	310
86 ft. 6" CMP	@ $2.50	212
		$11,717

The other type of structure is the concrete culvert with a chute outlet. An example is the chute type structure constructed in the Habinck sub-watershed 5 miles west of Mapleton, Iowa. This structure which replaced two bridges is designed to carry the full flow of a gully through the culvert and down the concrete chute without erosion. The drainage area is 1,122 acres. The flow from 995 acres is controlled by upstream detention structures. The peak outflow from these upstream structures is 436 cfs. The uncontrolled peak flow from 127 acres is 380 cfs. This makes a total of 816 cfs that the culvert with the chute must carry under the road without erosion.

The reinforced concrete structure consists of three parts: 1) The culvert section is 16 ft. x 11 ft., similar to the standard used by most State Highway Commissions. It provides a 24-ft. roadway; 2) the chute section is 16 ft. wide with sidewalls 5½ ft. high. It is constructed on a 3:1 slope; 3) the outlet is constructed as an energy dissipator. It reduced the velocity of water in the chute from 35 fps to 4 fps in the grassed channel below. The invert inlet is at elevation 1187 and the floor of the outlet is at 1165.0. Total drop through the structure is 13 ft. There are 24,760 cu. yds. of compacted soil in the fill and the 24-ft. roadway is at elevation 1190.0. The toe drainage system is similar to the system used on the 24-in. drop inlet structure in the Lum Hollow sub-watershed.

The contract cost of the structure built in 1951 is itemized in Table 2.

● **TYPICAL deeply eroded gully. The bridge shown, and an adjacent one, have been replaced by erosion control dams.**

Table 2—Cost of a Structure Built in 1951

24,760 cy compacted fill	@ 26¢	$6,437
1,000 cy excavation	@ $1	1,000
175.51 cy rein. conc.	@ $50.50	8,863
23,725 lbs. rein. steel	@ 16¢	3,796
142 ft. 6" perf. CMP	@ $7	994
16 ft. 6" CMP	@ $2.50	40
		$21,130

Both structures are very effective in preventing erosion along roadways and on adjoining farm lands.

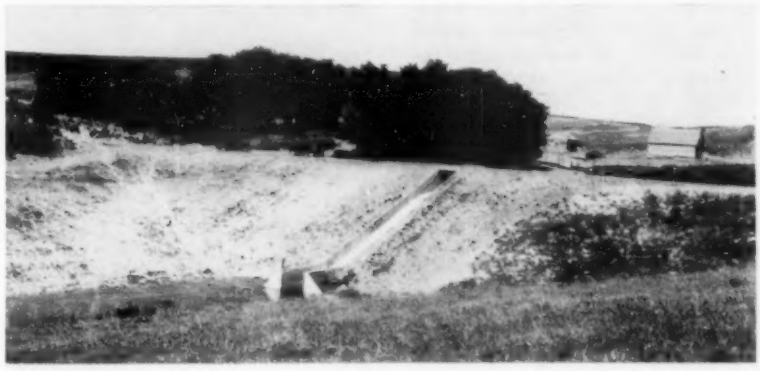
Not only are the counties cooperating with the Soil Conservation Service and soil conservation districts in the sub-watersheds, but they are also installing erosion control structures outside the sub-watershed areas. Between 1953 and 1959 they constructed 73 of these structures, and have found that the maintenance on them is almost nothing. The original cost of these structures in many cases is less than a new bridge, and their life expectancy is much longer.

A variety of specialized machines are used by contractors for this work. These include scrapers for fill work, draglines for excavations of sites and footings, and motor patrols and bulldozers for leveling and smoothing. The sheepsfoot roller, capable of exerting a ground pressure of 200 psi., is used extensively for compaction work. Air hammers are used for compaction work against concrete and in less accessible areas.

Farmers in the Little Sioux Watershed are unanimously in favor of these erosion control structures on public roads. In addition to the tremendous saving in tax dollars and less land destruction and flood damage, they benefit in many other ways. There is less land depreciation and damage from sediment deposits in drainage ditches, roadside ditches, and on bottom land crops. There is less damage to fences and private crossings and fewer losses of livestock that fall into gullies. Benefits result from changing the void area of the gullies to grass and pasture and from the increased water supply for livestock. The entire community benefits from recreation and better fishing and picnicking in the reclaimed areas.

Other agencies cooperating with the soil conservation districts in the Little Sioux Watershed are the U. S. Bureau of Public Roads and the Iowa State Highway Commission. These agencies recognize the benefits of mutual assistance and have incorporated erosion control measures in their work in this area.

● **AN EARLY** stage in constructing a dam to replace an old wooden bridge. Scraper is placing dirt for the dam and this is being compacted by sheepsfoot in foreground.



● **EROSION** control structure is designed to carry the full storm flow from the gully through the culvert and down the chute outlet without any erosion occurring.

● **ROAD-USERS** view of an erosion control job. Drop inlet with 24-inch pipe replaced a bridge 100 feet long. Storage is provided for 83 acre-feet of storm water.

THE EFFECT OF Interchange Spacing

STEFAN SALEK,
Senior Engineering Assistant,
Texas Highway Department,
Austin, Texas

INTERCHANGES should be located in order to facilitate the collection, discharge and dispersal of traffic. A proper time to consider the location of interchanges should be during the preliminary freeway location studies. At this stage, adverse conditions may be easily avoided. The selection of a proper type of interchange and the choice of location may have to be compromised due to the presence of railway or transit facilities, public utilities and topographic features such as rivers, streams and drainage channels. The freeway location should be removed, as far as possible, from the existing street intersections. An irregular street pattern, in general, would require more interchanges than a regular street pattern.

Since the development of freeway facilities originated in the densely populated areas, I believe that it would be proper to discuss the problem of interchange spacing in the urban and suburban areas first. Although several attempts were made to establish a proper interchange spacing, in my opinion each location should be analyzed separately and the values given in this or any other discussion should only be used as a guide. However, it should be remembered that a freeway with sparsely located interchanges will not provide the necessary service despite the fact that this solution may be less expensive initially. A freeway with too many interchanges, on the contrary, will not be efficient and will not function properly. The matter of economics should be considered and the final decision should be based on the road-user benefits derived from the construction of the interchange.

The City Master Street Plan contains a great deal of valuable information on the present and future land use and it may provide a clear picture of the population trend and the anticipated industrial, business and residential expansion. The location of interchanges should be established only after consideration of the pattern of the existing and the proposed arterial streets indicated by the City's Master Plan. Consultation with appropriate city officials in the early design stages will eliminate future confusion and disagreements and will provide a plan that will be equally beneficial as a local service and through traffic facility.

The location and spacing of interchanges will be affected by the size of the city and the type of area.

Business, and especially the Central Business Areas, may require construction of additional ramps, and in some cases, a "tailor made" dispersal system may be necessary. Special attention should be given to the presence of available parking areas and transit facilities. In the Industrial Areas, the problem is further complicated by the relatively high volume of trucks and the peak hour traffic volumes. Any type of industrial expansion may greatly increase the traffic load on the proposed freeway facility.

In the Residential Areas, the freeway location may separate the integral parts of the community, such as schools, churches, stores and emergency facilities. Interchanges will be required to re-establish circulation of traffic and to facilitate the movement of fire equipment, police and emergency medical facilities.

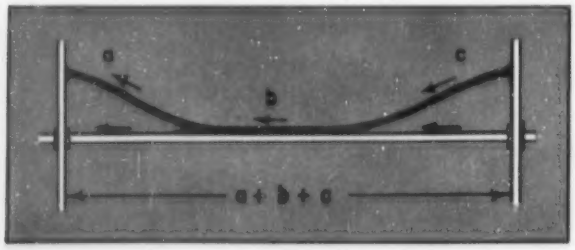
Other related factors that may affect a free choice of the designer would involve legal, political and military considerations.

An effective tool in determining the proper location of interchanges is the Origin and Destination Survey. Based on this, a fairly accurate traffic estimate can be prepared giving the anticipated traffic volumes and turning movements at each desired location. Approximate locations, spacing of exit and entrance ramps, and the type of interchanges can be selected by a judicious analysis of the anticipated traffic volumes.

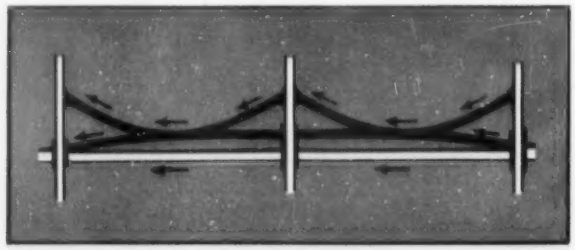
Arterial Streets and Highway Routes, in general, carry large volumes of traffic and should be separated. Minor streets can be terminated or frontage roads may be used to restore circulation. Any such change, however, should be thoroughly investigated as it may upset the existing traffic pattern and it may add a considerable amount of traffic to the proposed interchanges.

Turning Movement

The spacing of interchanges will be affected by the design speed of the facility, the number of lanes and the type of ramps. Close scrutiny should be given to adequate length of ramp to permit proper transition speeds, to conform with the recommended change in rate of superelevation, and to provide minimum possible grades. For a heavy turning movement, an additional length of ramp may be required to provide adequate storage space and area for the construction of directional islands which may be used in conjunction with traffic signals. The requirement for proper signing



● **FIGURE 1. Length of the weaving section "b" is an important factor in design where interchange spacing is short.**



● **FIGURE 2. A series of very close interchanges may require collector-distributor roads to reduce weaving effect of traffic.**

will necessitate additional distances to allow adequate perception time, reaction time to slow down if necessary, and time for such maneuvers as moving from one lane to another.

In urban areas the close spacing of interchanges will produce weaving sections, which usually have an adverse effect on the operation of the freeway. This weaving between the interchanges is in addition to the weaving section encountered in the cloverleaf and rotary interchanges.

When a weaving section cannot be avoided, its design should be carefully analyzed. In Figure 1 the total distance between the interchanges consists of two ramps "a" and "c" and of a weaving section "b". The weaving section is a combination of an acceleration lane and a deceleration lane. On any high volume facility, the length of speed change lanes should conform to the recommended values given in the design tables. For the usual urban design speed of 50 or 60 mph, the combined length of speed change lanes is approximately 800 ft. According to O. K. Normann, Chief of the Traffic Operations Branch in the Bureau of Public Roads, weaving capacity should be investigated unless the two ramps are more than 2000 ft. apart. This distance is based on the fact that ten percent of vehicles shift lanes within each 1000 ft. for reasons other than those connected with entrance and exit requirements. To this extent, the effect of vehicles shifting lanes is therefore included in normal capacity determinations of multi-lane highways. Since the length of a weaving section in urban areas is considerably less than 2000 ft. the actual length of the weaving section should be compared with the recommended values.

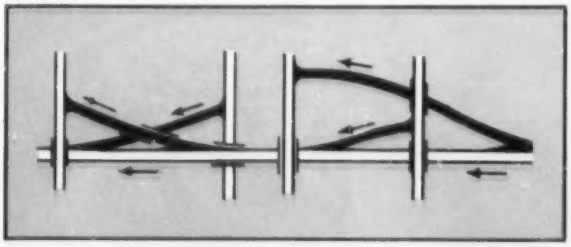
● **EASTEX Freeway and Loop 137 interchange in Houston illustrates typical design. Size of city and type of area materially affects location and spacing of interchanges.**

Based on the anticipated traffic volumes, the length of the weaving section can be determined from the weaving chart and should be at least equal to, and if possible, should exceed, the values given in the chart. The formula for the number of lanes should also be consulted to determine whether the available number of lanes corresponds to the values obtained from this formula.

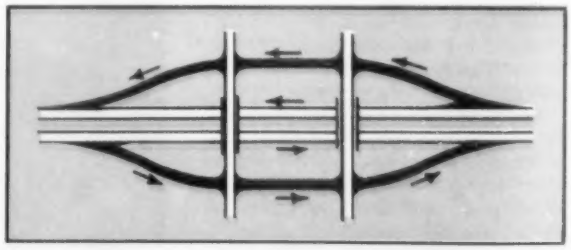
In the industrial and business areas, the percentage of trucks may require a longer weaving section, especially when weaving maneuvers take place on an up-grade. At a major interchange, the effect of weaving may be extremely critical since part of the ramp traffic may have to weave across the main lanes.

Collector - distributor roads and braided and separated type ramps may be required to reduce the effect of weaving on the flow of through traffic as shown in Figures 2 and 3. A split type interchange especially at a pair of one way streets, may also be used to good advantage and this is shown in Figure 4. A grade separation structure or a partial interchange, without a full component of ramps can be provided when the turning movements are low and can be diverted without much difficulty to adjacent interchanges. This may be required in certain instances to re-establish continuity of intercepted local street systems. The effect of weaving may be eliminated by reversing the usual pattern of ramps to produce weaving on the frontage road. Weaving on the frontage road may be less critical, as the weaving maneuver can take place at slower speeds.

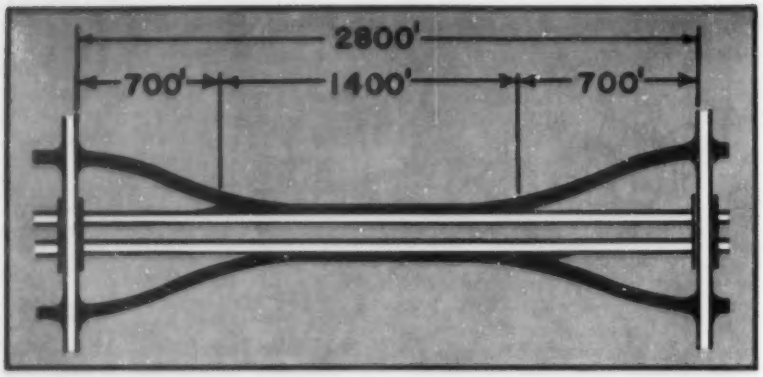
According to Jack Leisch, who has compiled data on this subject, 1800 ft. between interchanges represents the absolute minimum spacing in urban areas; 2600 ft. is a normal spacing and 4200 ft. represents the preferable minimum value. On the existing freeways, the average interchange spacing is approximately 0.5 mile and it varies from 1750 ft. to 4000 ft. The average spacing of 0.5 mile corresponds with the normal interchange spacing recommended by Mr. Leisch, and it provides somewhat greater length



● **FIGURE 3. Two other means of reducing weaving effect on freeway: Left, braided ramps; and right, separated ramps.**



● **FIGURE 4. Split diamond interchange is especially useful where a pair of one-way streets crosses over the freeway.**



● **FIGURE 5. Absolute minimum spacing between rural interchanges is 2800 feet.**

than required for weaving of maximum single lane volume of vehicles.

The average interchange spacing in the suburban areas is approximately 8000 ft. but varies from 4800 ft. to 11,000 ft.

In Texas, the average interchange spacing in urban areas is approximately 2200 ft. varying from 1700 ft. to 4000 ft.

Rural Areas

The construction of controlled access facilities in the rural areas was fairly limited prior to the passing of the law authorizing the Interstate Program. The Federal Aid Highway Act of 1956 established the controlled access provisions for the entire Interstate Highway System. Intersections at-grade may be permitted under the two following conditions:

a) Each intersection at-grade is with a public road or private driveway with little potential for traffic increase and on which the current ADT does not exceed 50 vehicles.

b) Such intersections do not exceed two per side of the Interstate Highway per mile. These conditions may exclude the separation of private driveways and some low volume County Roads; however, most of the Farm-to-Market Roads, State Highways and US Highways will be separated. According to the Needs Estimate, interchanges in the rural areas would not be at uniform spacings, but would average 3 to 8 miles. In or near small cities, interchanges will be needed only at the truck routes that enter or pass through the urban areas.

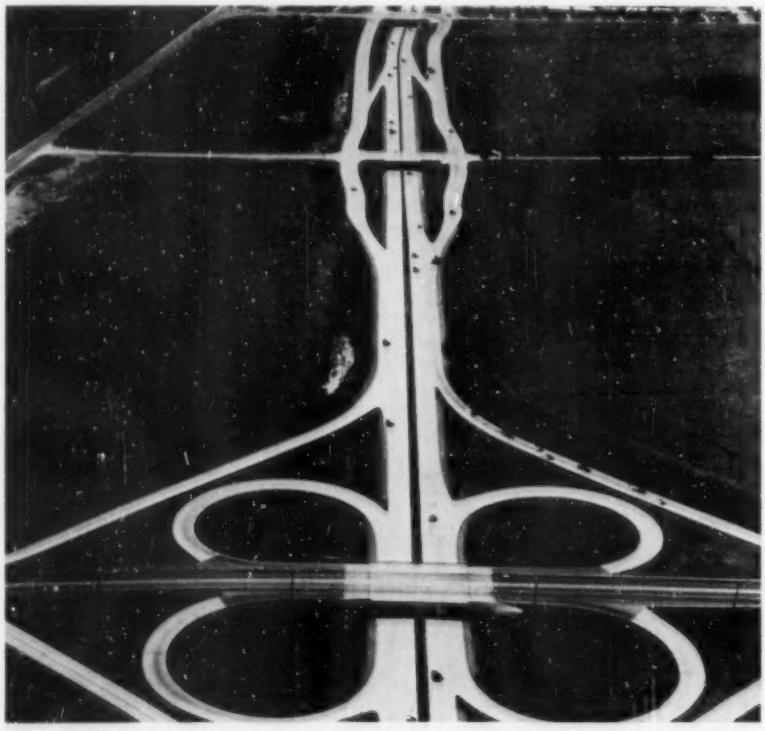
On some of the constructed Interstate Highways in Texas, the average interchange spacing varies from approximately 1.0 mile in the more populated areas to 6.0 miles in the sparsely populated areas.

There is no definite standard regarding the provision for an interchange on the State Controlled Access highways. In general, the location and spacing of interchanges conforms to the Interstate Design Standards. However, due to the limit on the available financing, the development of full control of access usually is accomplished by stages; with a provision that no crossroad carrying less than 2000 vehicles per day, current volumes, should be separated.

In rural areas, the problem of weaving is not critical since the combined length of the acceleration and deceleration lanes usually exceeds the required length of weaving section. Accordingly, a distance of about 2800 ft. may be assumed to be the absolute minimum spacing for rural interchanges as shown in Figure 5. Vertical alignment should be carefully examined for steep grades. Excessive grades may affect the length of the weaving section and the length of the speed change lanes. The previously mentioned 2800-ft. distance is based on the assumption that the minor highway will overcross the major facility which closely follows natural grade. When the main lanes overpass a minor highway, the close spacing of interchanges may produce a "roller-coaster" profile. For a 70 mph design speed, the minimum distance between two overpasses should be at least 3600 ft.

All factors being equal, it may be safely stated that the construction of a minor road overpass will be less expensive than carrying the main lanes over. Moreover, when the freeway overpasses a minor highway, the road-user benefits derived from the construction of the interchange are minimized, since a larger volume of traffic will have to be lifted the usual vertical distance of 18 to 18.5 ft. An underpass structure will also lend itself more readily to stage construction.

This paper was presented at the 33rd Annual Short Course in Highway Engineering at Texas A & M College and has been slightly condensed here.



● **AERIAL VIEW of Dallas Expressway shows the familiar cloverleaf, a split diamond interchange and collector-distributor roads. Note the wider weaving sections.**

YEARS OF SERVICE *prove value of* AUTOMATIC TIME RECORDER

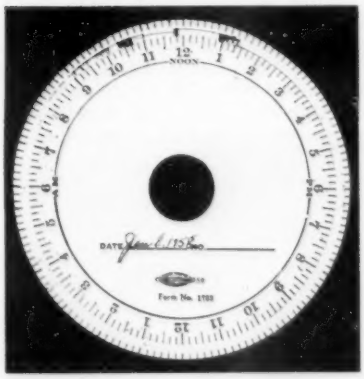
VINCE BOVITZ,
Public Information Director,
Minnesota Department of Highways

THE USE of automatic time recorders on certain types of highway maintenance equipment has long been a standard policy of the Maintenance Division of the Minnesota Highway Department. For nearly 25 years the division has been using a recorder that has constantly satisfied the requisites of efficiency and economy which justify the use of such a recorder. This is the Model K Servis Recorder manufactured by the Service Recorder Company in Cleveland, Ohio.

There are now approximately 1000 Servis Recorders in use throughout the 16 maintenance districts of Minnesota, and another recorder is purchased whenever a new piece of equipment requires one. The recorder, which is secured on or near the control panel of equipment, is a simple and compact mechanism about five inches in diameter and two and one-half inches deep. Enclosed within its metal case are a clock unit to which a waxed-paper time disk is attached and a pendulum with a stylus attachment that rests on the edge of the disk. The operational time recording process is activated by the vibrations caused by the equipment in operation. These vibrations, to which the recorder is extremely sensitive, agitate the pendulum to a degree more than sufficient to impress a dark line upon the time-measures of the revolving disk.

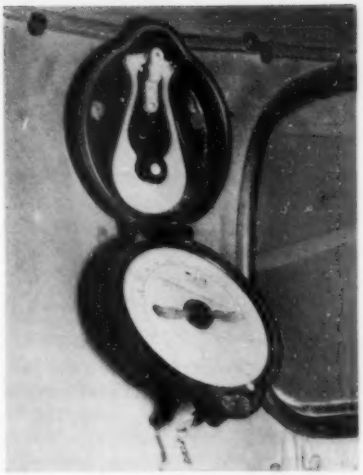
The major purpose of the Servis Recorder is to obtain data on the operational time of certain types of highway maintenance equipment. Under the Minnesota Highway Department's equipment rental system, all state-owned equipment is assigned to the maintenance districts on either an hourly, daily, or yearly rental basis for the purpose of accounting the cost of equipment operation. The recorders are used on all trucks and on heavy equipment such as tractors and graders that are in regular use on the hourly rental basis, which comprises the majority of the Highway Department's maintenance equipment.

The rental rate, which is based upon operating costs and is set up to include gasoline, oil, grease, repairs, storage and an allowance for depreciation and proportionate share of overhead, is charged to each piece of equipment. The cost of equipment operation is then charged to the control section of the trunk highway system where the work is performed, and in turn to the maintenance district. The Servis Recorder, then, provides the means for determining exact rental time which is vital in maintaining these records.



The data obtained by the recorder is transferred from the time disk to a daily time sheet which is kept on each piece of equipment, and from the daily time sheets a monthly cost analysis sheet summarizing the cost of equipment operation in each maintenance district is accomplished. The time disks are kept in chronological file for a period of six months and are then discarded; but the daily time sheets are maintained on permanent file for future reference and comparison studies.

Although its major purpose is to record equipment operational time, the recorder serves other purposes.



● **RECORDER opened showing pendulum with the stylus and a time disk.**

However, inadvertently, it keeps watch on the equipment operator in the performance of his duty. Consequently, because the recorder indicates operational time to the minute, if the operator should neglect his duty assignment or overstay relief or lunch periods without reasonable cause, his negligence would be attested to by the unmarked spaces on the time disk. The recorder, then, is an efficient and irreproachable time keeper, for which reason the operator calls it a "stool-pigeon." In addition, the recorder provides information that permits comparisons on equipment use to be drawn between the several maintenance districts, and in some instances improved equipment operation and better work performance can be initiated.

Since the first year it was used, the Servis Recorder has given adequate evidence that it satisfies the requisites that justify its use. The economy of the recorder is accounted for by its simplicity of construction and by its durability. When the clock unit, which is similar to and as accurate as the typical alarm clock, indicates it is either gaining or losing time it is replaced; this is less expensive than employing personnel to repair the inexpensive unit. About 200 replacement clocks are bought annually, but considering the continual vibrations the recorder sustains, the number of replacements necessary each year is relatively small. Replacement of the other components of the recorder is negligible. This, combined with the efficiency of the recorder which has been proven through years of service, is reason enough for continuing the use of this particular recorder.

PUT IT ON MICROFILM!

F. A. CERWIN,
Records Administrator,
Cook County Highway Department,
Chicago, Illinois

WHEN William J. Mortimer was appointed Superintendent of Highways for Cook County, Ill., in 1953, immediate procedural changes were initiated. The records of the Highway Department were in need of reorganization, so a Records Administrator was appointed and a survey of all records made from which a long range plan was prepared and immediate steps were taken in the change-over to a new and modern system of records keeping.

The Mail Division was streamlined, new equipment purchased, incoming and outgoing mail expedited, reproduction of work copies to the various division heads transmitted in a third of the time previously required and a program for the preparation of forms and the control of same was initiated.

This was only the beginning, since the engineers, the men on the drawing boards were putting forth plans in such volume for the Interstate Expressways Program that 1958 would see projects under contract to the astronomical figure of $100,000,000. The Superintendent felt these men, the nucleus of the Highway Department, should be given the means and methods of expediting this mass of data.

The 22" x 36" ink tracings, upon completion of a project, are stored in a vault at one of our outlying warehouses and over the years plans, specifications, correspondence, and other records had accumulated to such proportions that facilities and personnel were taxed; referral service to the engineers was becoming a problem. Original plans needed by the engineers were being delayed; a telephone call was made to the storage vault, the plans removed from file, an "out-card" filed in its place, plans delivered to the downtown office and after examination by the requesting engineer and Diazo prints made, the plans were returned to the storage vault, refiled and the "out-card" pulled. The overall transfer time in some instances amounted to days. This time element had to be reduced, and procedure and methods were sought to obviate these existing conditions.

Some eight months ago, permission was granted the Records Administrator, under supervision of A. V. Plummer, Assistant To The Superintendent, to make a survey of these conditions with the possible use of microfilm for filming our drawings. The following questions had to be answered in this survey, since the answers would determine the process and equipment that could be used:

Accessibility and Availability. As briefly outlined above, the delays before the engineer was able to derive information from the plans were hardly conducive to a high morale, and the continual transfer of these originals to and from the storage vault was causing wear and tear with resultant loss in legibility. The question was: "How to give the engineers immediate access to these drawings and yet preserve the originals?"

Security. Since only approved tracings of already completed highways are stored in the vault, the probability of fire, loss or damage of these originals and records had to be considered and in the event of such catastrophe: "How could this data be replaced?"

Space. This problem was prevalent in the Records Room in the downtown office and the storage vault was no exception. Material was constantly being added and retained—but seldom was anything ever removed because of age, obsolescence, disuse or no further need to retain the record.

Safety. The engineers in the various drafting rooms were withholding completed plans normally sent to the storage vault; the feeling was prevalent that, if the plans were not to be immediately available, "Why

● SPACE saving feature of filming engineering drawings. At right is the microfilm image of the drawing at the left.

● ON THE JOB: At the left is the full-sized drawing; a reduced size copy made from the microfilm is shown at right.

not store them in the downtown office, since they then would be immediately accessible and available upon demand?" These plans as a consequence were being retained in the drafting rooms, filed by highly paid engineering personnel and housed in equipment purchased in addition to the cabinets used for work in progress.

Tracings. Many man hours are used in tracing the pencil drawing onto cloth with ink and this tracing is then sent out for intermediates, film negatives, B.W, and blue prints for distribution to bidders and engineers on construction. The standard size of sheet used in the Highway Department is 22″ x 36″ and with the complexity of detail necessary on some plans, a set of plans could be bulky to handle and weighty, with perusal an ordeal. Our questions: "How could the same amount of information be gathered on a smaller sheet and yet have the excellent detail of a larger sheet?" and "How best to transfer the pencil tracing to cloth or equivalent and eliminate the secondary step of ink tracing?"

These problems were discussed with the film agencies and equipment suppliers in the Chicago area and, after experiments on microfilm ranging from 16mm to 105mm and after testing reproductions from these films on paper and cloth as to line definition, dimensional stability and resolution, based on the majority of our work and the cost and upkeep of this equipment, we decided on 16mm and 35mm as an all purpose media and the most probable answer to our problems.

These final tests were made with the cooperation of the Recordak Corp. and the facilities placed at our disposal were the most modern in the field of microfilm; we also felt that Recordak, specializing in this field of engineering drawings and the constant development of new films and controlled processing would give the County the best quality at less cost and excellent service.

The Commercial Model RE-1 was purchased for 16mm microfilming and was put to immediate use. All of our County Zoning Permits issued since 1940 and formerly filed in eight four-drawer cabinets (40,000 Permits in number) were microfilmed and contained on 50 rolls of film; in addition 50 rolls of positive film were made for security purposes. The file space saving was immediately evident and accessibility to the records is immediate through the use of an MPE Reader; hard copies may be obtained from these rolls either by enlargement on inexpensive paper, electrostatically onto a web of paper or by photographic enlargements to an offset plate.

This was the beginning; our biggest concern was the thousands of 22″ x 36″ tracings stored at the storage vault, housed in 12 tiers, 15 drawers high, (drawer size 4″ x 30″ x 36″) each drawer containing some 10 to 15 large brown envelopes, each with a complete set of plans. The Cook County Highway Department decided that all this material should be microfilmed and the negative camera film be mounted in Filmsort Military D Aperture Cards, 3¼ x 7⅜″. The tracings are to be microfilmed in accordance with Recordak precision engineering specifications, at a reduction of 22 diameters. The card is further imprinted with the name of the road, limits of project, our section number, sheet number and project type construction. These cards are being filed in alphabetical sequence by road name and then numerically by section number; the cards are at present found manually

● **MESSRS. Plummer (left) and Cerwin (right) go to the file to check a microfilm drawing of a field construction job.**

but may be adapted to tabulating machine techniques. This is an answer and solution to our first question of accessibility and availability—for it is now possible for an engineer to request a set of plans by way of a deck of aperture cards and upon viewing the deck on the viewer, is able to determine the sheet or sheets needed; should a hard copy blow-back of the card be required, modern equipment now on the market, can reproduce in a matter of minutes. It will not be necessary to return this print, after use it may be destroyed. The aperture cards now filed away are immediate aperture cards, 51,000 at this writing, ately available upon call. These are housed in sixteen drawers, each 28″ x 15″ x 3½″. It is our hope after the drawings are put on aperture cards and duplicate security rolls made, that all drawings may be destroyed after a period of retention which would do away with the large cabinets now in use at our storage vault.

Security wise, a positive roll of film was made at the same time the aperture cards were prepared and this roll is stored separately and filed numerically but cross indexed to the aperture cards. This positive film roll is doubly useful since by projection on the Kodak Enlarger the image may be transferred to a Xerographic Plate and to a paper or metal master for volume output of hard copies on a multilith press; secondly, should the aperture cards be damaged, destroyed or lost, duplicate aperture cards may be made from the Security Roll.

With the storing of the aperture cards in the Records Room and in the immediate vicinity of the Drafting Rooms—access time to the requested drawings is now cut to a minimum; blow-back prints may be made at once and there is no further need to store or return these prints after examination as they are expendable. This should further cut the cost of any additional cabinets.

Plan size has been a subject under consideration for some time. Tentatively, pending approval by other agencies, the Cook County Highway Department is in favor of the 11″ x 18″ paper or vellum size with the 10″ x 16″ image area, as it appears to satisfy the majority of engineers. This print is of excellent quality and of good resolution and stability. Heretofore, 11″ x 18″ prints were being made by other methods but did not prove satisfactory. This 11″ x 18″ with 10″ x 16″ image, seemed ideal to our personnel and the expense a fraction of the 22″ x 36″ large print. It is our hope that should this sheet size be adopted here at the Cook County Highway Department, the outside agencies will follow suit.

As a further example, in the new system the first generation copy of the engineering drawing is a silver film negative. The second generation can be any number of reproduction types—dry or wet process film copies; silver diazo or electrostatic hard copies. The second generation media, in turn, can be processed into further combinations,additional film copies or hard copies from film —contact prints or offset reproductions from hard copies. This is evidence to what extent microfilming may be used in this era of automation and integrated processing.

CONTROL CENTER

FOR MILWAUKEE'S WATER WORKS

ARTHUR RYNDERS
Superintendent of Water Works,
Milwaukee, Wisconsin

EXPERIENCE over a period of years has indicated that there is much to be desired in the flow of operating information within water utility systems. Desirable factors are: 1) the collection of information on which to make operating decisions; and 2) the transmission of these decisions in the form of operating instructions.

Our existing facilities consisted of commercial telephones in each of the operating facilities; a water utility radio system with a console in the Water Distribution Division office with receiver-transmitters in 14 of our trucks; and a few liquid level transmitters between storage and pumping facilities.

Looking for improved methods we found many ideas, two of which were of particular interest. One was the centralized information and dispatch system in the Atlanta Water Works and the other was the data logging equipment shown at the AWWA convention in Dallas, Texas.

Keeping in mind all that we had seen and heard, we proceeded to assemble our ideas.

First of all, we decided upon a name—Control Center. Its function was determined to be the control of the operations of the water utility to the end that better water service would be rendered to the customers.

The Center, in the new City Hall Annex, is on a floor used almost exclusively by the water utility. It is manned by dispatchers 24 hours a day with a Chief or Deputy Chief of Water Works Operation available at all times. All the maps, atlases, plans, data, etc., which may be required for every conceivable operating situation, are arranged for quick and easy reference.

The means provided for the flow of information are of five principal types: 1) Data logging—27 bits now, 3 more soon and 17 more in 1961; 2) telephones—Water and Utility PBX; 3) radio, including transmitter, receivers at principal stations, certain supervisors cars and numerous trucks; 4) written—typed and longhand; and 5) charts from outlying points in the distribution system.

Specifications for the data logging system were prepared by the Water Engineering Division. In accordance with Milwaukee standard practice, the work of furnishing and installing the data logging equipment was advertised. The Fischer & Porter Co., being the low bidder, was awarded a contract which was completed within the specified time. At this writing the installation is operating under a 60-day guarantee period.

The accompanying article, by Alan L. Vink, describes: 1) the data logging system actually installed; and 2) how the system works.

Photo courtesy Fischer & Porter Company

● **OPERATION of the centralized electronic data logging system at the Milwaukee Water Department control center is demonstrated by the author to Mayor Frank P. Zeidler (center) and Lloyd D. Knapp (left), Commissioner of Public Works.**

ELECTRONIC INFORMATION SYSTEM *PROVIDES CENTRALIZED RECORDS AND OPERATIONAL CONTROL*

ALAN L. VINK
Senior Systems Engineer,
Fischer & Porter Company,
Hatboro, Pennsylvania

A NEW $100,000 centralized electronic data telemetering and recording system is helping Milwaukee get the most out of its present water utility system. The new information system measures 27 critical pressures, flows, and water storage levels at 12 widely-separated stations, telemeters the information over telephone lines to a central Operations Center, and records it automatically by typewriter. Equipment for three more units are on order. It is the first such automatic recording system to go into operation in a water utility in the U. S. The primary measuring instruments and the data recording equipment were designed, manufactured and installed by Fischer & Porter Company, Hatboro, Pa. Telemetering equipment was made by Hammarlund Manufacturing Co., Inc., New York.

Despite the fact that Milwaukee lies adjacent to one of the largest fresh water reservoirs in the world —Lake Michigan—the water problem is and will continue to be critical until a $54,000,000 expansion program is completed and in operation. Due to the saucer-like topography of Milwaukee, outlying areas are the highest, which adds to the pumping problem. Moreover, Milwaukee, like most other American cities, has experienced a rapid growth rate in recent years—in industry, area and population. The effect of this growth on the Milwaukee water system during the period 1953-58 can be seen in Table 1. In 1952, 732,800 people were being served. Five years later, this figure had reached 836,200, an increase of 14.11 percent. This rate of growth promises to continue without letup, and may even increase. In addition, with Milwaukee now a seaport, industrial water consumption is expected to increase greatly.

All of these factors—population growth, industrial growth and geographical growth—point to increased water consumption. Thus, more than ever before, Milwaukee officials must know exactly where they stand and where they are going.

In order to understand just what the new information system does, it is desirable to have some familiarity with the Milwaukee water system. The system is divided into two areas. Downtown Milwaukee near Lake Michigan is the low service area. The rest of the city, plus suburbs and outlying communities, is the high service area.

All water for Milwaukee is obtained from an intake through a 12-ft. concrete tunnel which extends 6565 feet into the lake from the 24-acre water purification plant

Table 1—Expansion of Milwaukee Water Works System 1952-1958

	From 12-31-52	*To 12-31-57*	*Numerical Increase 1952-1958*	*Percent Increase 1952-1958*
Est. Population (city only)	646,000	714,000	68,000	10.53
Population supplied (including suburbs)	732,800	836,200	103,400	14.11
Total Services	147,302	178,936	31,634	21.48
Miles of Main	1,435.99	1,797.22	361.23	25.16
Average daily consumption (gallons)	129,177,049	141,742,770	12,565,721	9.73
Hydrants in service	10,438	13,272	2,834	27.15

● **CONTROL CENTER of the Milwaukee Water Works is manned by an operator at all times. In the event of an emergency condition anywhere in the system, the source of the trouble can be detected from the readout record and service units dispatched.**

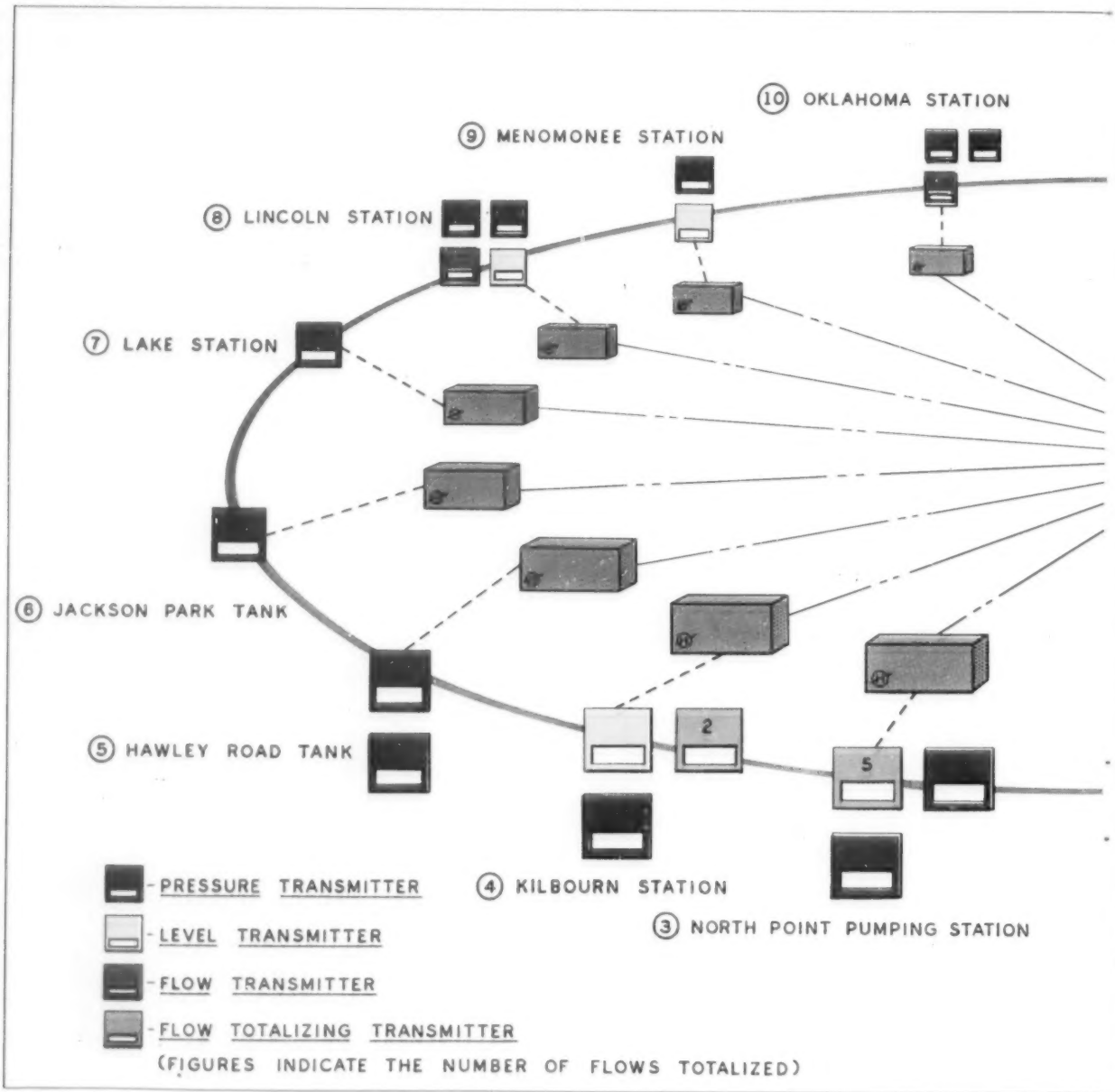
(point 1 on the diagram) located on the shore of Lake Michigan. The depth of water at the intake end of the tunnel is 67 feet. At this point, the tunnel is 150 feet below the level of the lake. A lake shaft with an internal diameter of 12 feet extends upward from the end of the tunnel to the intake. The inlet is protected by a submerged octagonal intake crib, 80 feet in diameter and 12 feet in height.

The water purification plant which utilizes rapid sand filtration, has a rated capacity of 200 mgd. However, it can be operated as high as 300 mgd. The plant consists of two coagulation basins, a filter building with 32 filter beds, and three filtered water reservoirs: one 13 mg, one 9.65 mg and the other 7.33 mg. Water is pumped from the purification plant to Riverside (2) and North Point pumping stations (3).

North Point pumping station has an installed pump capacity of 126 mgd with four pumps supplying water to the low service area including Kilbourn Reservoir (4). Another four pumps serve the high service area during peak periods in conjunction with Riverside.

Riverside pumping station is the key station for the entire high service area. It has an installed pump capacity of 264 mgd. It delivers to the high area, including the 1 mg reservoir at Lake Station (7), Jackson Park elevated tank (6) with a capacity of 1½ mg and Hawley Road elevated tank (5), also with a capacity of 1½ mg.

In addition, there are two booster pumping stations, Lincoln station (8) and Menomonee Valley station (9), both with storage reservoirs, 12 mg and 18 mg respectively. Three booster stations, Oklahoma (10), Bluemound (11) and Capitol (12), plus portable pumping units, complete the system.



● **CENTRALIZED** Information System of the Milwaukee Water Works collects pressure, water level and flow data from

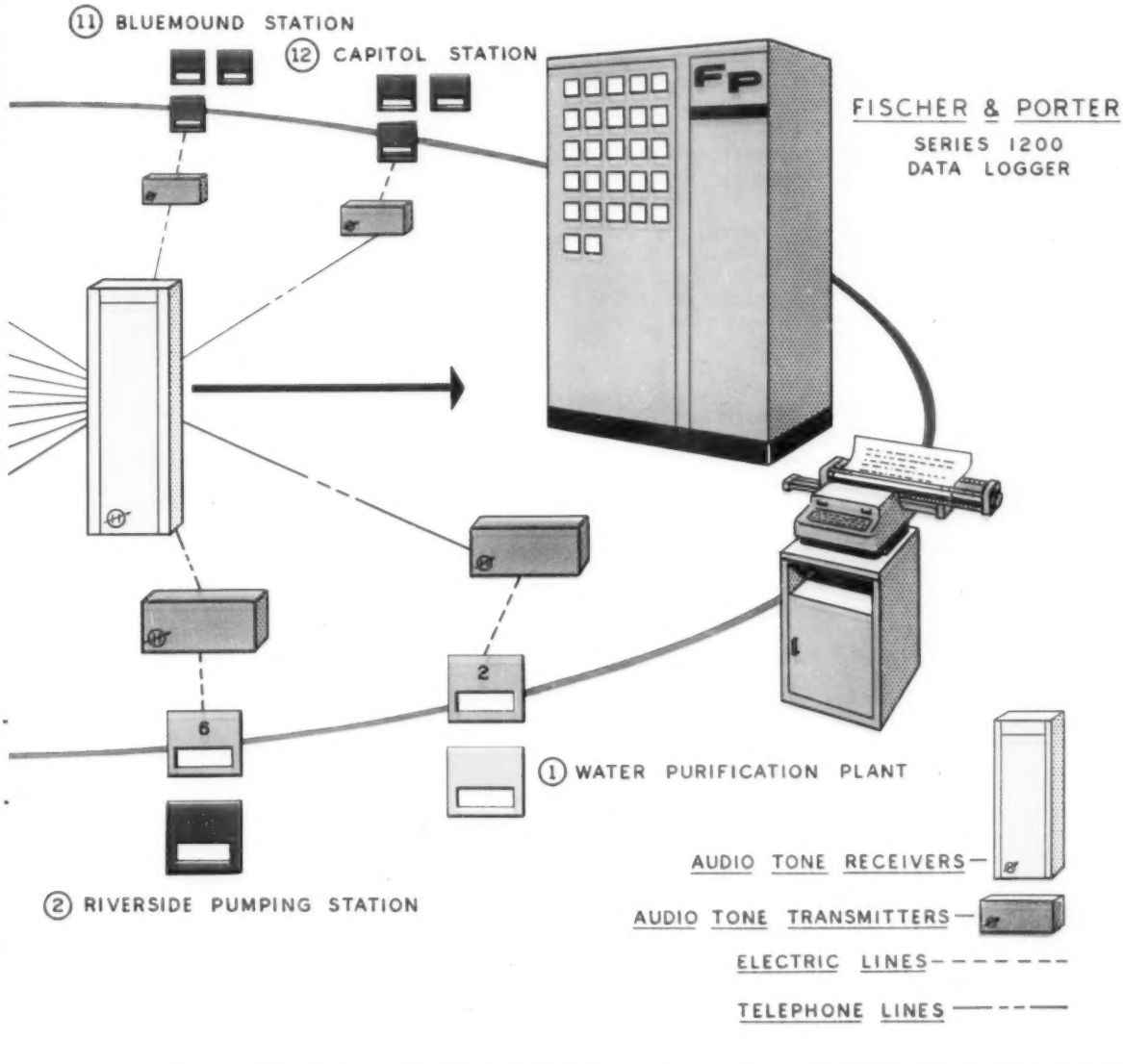
At night, all reservoirs are filled to capacity. During the day, the pumps are able to handle demand until late afternoon, when it becomes necessary to draw from the tanks and reservoirs. These remain on the system until about 10 P.M. when it becomes possible to start filling the tanks again.

Average daily consumption ran about 142 million gallons during 1957. On peak days it is necessary to pump over 200 million gallons, and at such times, the system is operating beyond the rated capacity of the water purification plant.

Operation of any water system over capacity naturally causes problems. It is necessary to stay alert for main breaks, low pressure areas, and other abnormal or subnormal conditions that would lower the quality of service or disrupt it entirely.

Before installation of the Information System, conventional chart recording devices located at various points were used. The "chart crew," as they were called, made the rounds of these instruments and checked them. If a serious condition existed, the man would call the Distribution Center. Distribution would then dispatch a radio service truck or car to the trouble point. Unfortunately, the weak link in this chain was the time it took to spot the trouble initially. It takes time to travel around from point to point checking records. Sometimes trouble would be reported by citizens before the records were seen.

Now, if there is a breakdown or drop in flow, it is evident instantaneously through the record provided by the Information System. Often, potential trouble can be detected even before it develops. The old saying about "an ounce of prevention" is as true for water utility operation as for anything else.



twelve remote stations. At the Control Center the Data Logger feeds these data to the automatic readout typewriter.

● **TWO V/A CELLS (flow measuring instruments) at the Purification Plant are shown at the right. Walter Wendt, Water Plant Design Engineer, points to the flow totalizing transmitter. The dual tone transmitter is mounted on column at top.**

The Fischer & Porter Telemetering & Data Recording System (refer to the diagram)consists of: a) The necessary transducing instruments to measure, indicate, and/or record locally and to retransmit flow, level and pressure values; b) the telemetering facilities for distant transmission and reception of these signals over telephone lines; and c) the data recording equipment required to convert and record these signals in digital form (typewritten log sheets).

Instrumentation

There are four basic types of Fischer & Porter instruments used in the system:

V/A Cell Ori-Flowrators. These instruments, thirteen in all, are kinetic manometer type flowmeters. They measure bypass flow as a function of main line flow across a set of orifice taps. Main line flow is indicated on a linear scale and an electrical signal linearly proportional to main line flow is transmitted to a suitable receiver.

In operation, bypass flow passes through a variable area metering tube in which a float is located. The velocity of the flow lifts the float within the tube and the position of the float indicates the flow rate. Through a magnetic bond, a follower arm is positioned by the float. A pointer attached to the follower arm provides a visual indication on a segmental scale and, through a linkage, movement of the follower arm positions the armature of a differential transformer which determines the output voltage of the instrument.

This electrical output, which is linearly proportional to flow rate, is transmitted electrically to one of the flow totalizing transmitters described below.

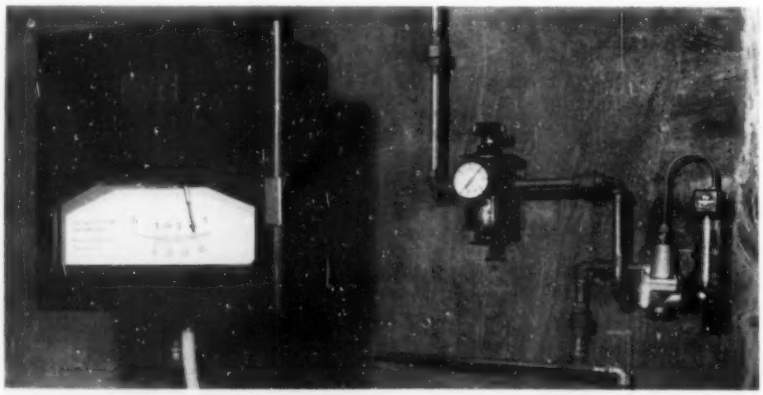
Flow Totalizing Transmitters. These are secondary instruments in the sense that they do not actually measure the process variable, but accept electrical inputs from the V/A Cells. There are four of them in the system. They indicate and transmit a pulse time signal proportional to the sum of the V/A Cell inputs.

Each of the totalizers contains a differential transformer similar to the one in the V/A Cell. This is held in balance with the sum of the V/A Cell inputs by means of a servo motor operated by an electronic amplifier. The position of the armature of the differential transformer in the totalizer is indicated by a pointer to provide visual readings of the summed flow rate. In addition, the armature position determines the duration of the electrical pulse produced by a pulse time transmitter connected to the totalizer. The total time cycle for each signal is 15 seconds. At mid position, the pulse is on for 7½ seconds and off for another 7½. If the process signal level changes, a pulse of different on-off duration results, but the total time cycle remains at 15 seconds.

Level and Pressure Transducers and Flow Transmitter. These instruments measure, indicate and transmit pulse time signals proportional to the measured process variable. There are four level transducers, seventeen pressure transducers, and one flow transmitter. Each level transducer has an enclosed bellows receiver to convert pressure to spindle position. The pressure transducers sense pressure by means of a spiral Bourdon element which converts pressure to a shaft position. The shaft is connected to the instrument spindle. Thus, ultimately the result is the same.

The flow transmitter, installed at the Kilbourn station, is the secondary instrument which receives a pneumatic process signal from a relay averaging signals from two previously existing primary flow measuring instruments. It uses the same principle as the level transducer, an enclosed bellows receiver. The instrument spindles of all of these instruments are connected to pointers which indicate readings visually. Spindles are linked to pulse time transmitters as described above.

Mercury Manometer Flow In-



● **WATER STORAGE level at the Purification Plant is measured, indicated and transmitted by this instrument. Double scale indicates both the storage and level.**

dicating Transmitters. These primary instruments, four in all, measure flow rate in terms of the differential pressure produced across an orifice plate. Changing pressure differentials move a buoyant float in a mercury filled U-tube manometer. As the mercury level changes, a linkage connected to the float through a magnetic bond positions the instrument spindle according to the flow rate. The spindle is provided with a pointer to indicate the flow visually and is linked to a pulse time transmitter.

These are the four basic types of instruments used to measure, indicate and transmit flow, pressure and level values at the twelve remote stations in the Milwaukee Water Works Centralized Information System. Pressure and level instruments have two scales. The upper scale indicates Feet Above City Datum (FACD) and the lower scale indicates psig or million gallons of stored water (MGSW).

Instruments are as follows:

1) WATER PURIFICATION PLANT

Two V/A Cells	0 to 200 MGD
Flow Totalizing Transmitter	0 to 400 MGD
Level Transducer	0 to 36.4 MGSW (0 to 31 FACD)

2) RIVERSIDE STATION

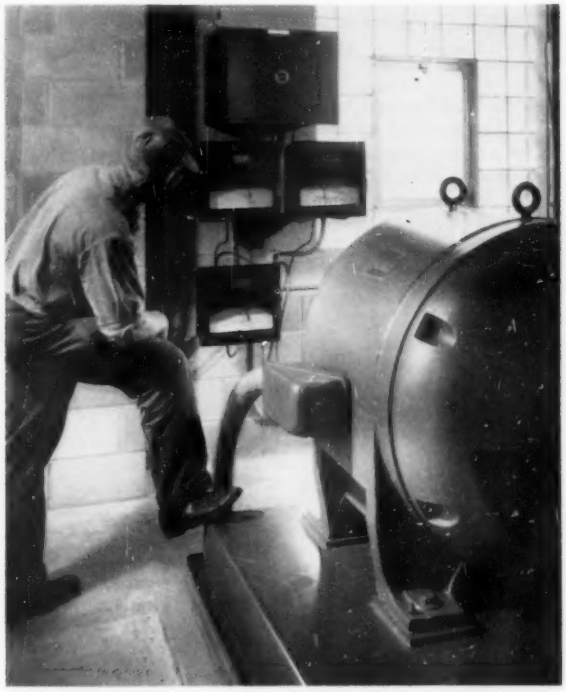
Two V/A Cells	0 to 40 MGD
V/A Cell	0 to 70 MGD
Two V/A Cells	0 to 90 MGD
V/A Cell	0 to 50 MGD
Flow Totalizing Transmitter	0 to 380 MGD
Pressure Transducer	0 to 150 psig (0 to 375 FACD)

3) NORTH POINT STATION

Two V/A Cells	0 to 29 MGD
Flow Totalizing Transmitter	0 to 58 MGD
V/A Cell	0 to 45 MGD
V/A Cell	0 to 23 MGD
V/A Cell	0 to 60 MGD
Flow Totalizing Transmitter	0 to 128 MGD
Two Pressure Transducers	0 to 150 psig (0 to 375 FACD)

Milwaukee Journal photo

● **TONE RECEIVER indicating units mounted on the Data Logger at the Control Center are inspected by Elmer Becker (left), Asst. Superintendent of Water Works, and Mr. Wendt.**



● **INSTRUMENTATION at the Kilbourn Pumping Station and Reservoir. Top unit is the Hammarlund tone transmitter; below this are the station's pressure, level and flow transmitters.**

4) KILBOURN STATION

Pressure Transducer	0 to 40 psig (0 to 220 FACD)
Level Transducer	0 to 29 feet (0 to 159 FACD)
Flow Transmitter	0 to 50 MGD

5) HAWLEY ROAD ELEVATED STORAGE TANK

Two Pressure Transducers	0 to 70 psig (0 to 295 FACD)

6) JACKSON PARK ELEVATED STORAGE TANK

Pressure Transducer	0 to 80 psig (0 to 275 FACD)

7) LAKE STATION

Pressure Transducer	0 to 70 psig (0 to 310 FACD)

8) LINCOLN STATION

Two Pressure Transducers	0 to 125 psig (0 to 365 FACD)
Level Transducer	0 to 15.1 MGSW (0 to 115 FACD)
Mercury Manometer Flow Indicating Transmitter	0 to 40 MGD

9) MENOMONEE STATION

Pressure Transducer	0 to 150 psig (0 to 360 FACD)
Level Transducer	0 to 21.7 MGSW (0 to 57 FACD)

10) OKLAHOMA STATION

Two Pressure Transducers	0 to 150 psig (0 to 500 FACD)
Mercury Manometer Flow Indicating Transmitter	0 to 4 MGD

11) BLUEMOUND STATION

Two Pressure Transducers	0 to 150 psig (0 to 475 FACD)
Mercury Manometer Flow Indicating Transmitter	0 to 4 MGD

12) CAPITOL STATION

Pressure Transducer	0 to 54 psig (0 to 290 FACD)
Pressure Transducer	0 to 100 psig (0 to 400 FACD)
Mercury Manometer Flow Indicating Transmitter	0 to 8 MGD

Choice of Instrumentation

Instruments were chosen for accuracy, simplicity, and economy—in that order. Since an accuracy of 1.5 percent average with a maximum deviation of 2 percent was required, instrument accuracy was the primary consideration. Simplicity is directly related to accuracy since in any complex system the greater the number of components, the more potential sources of error. Simplicity, therefore, was emphasized as a secondary consideration. Economy, in turn, is directly related

(*Continued on page* 152)

SLUDGE GAS UTILIZATION

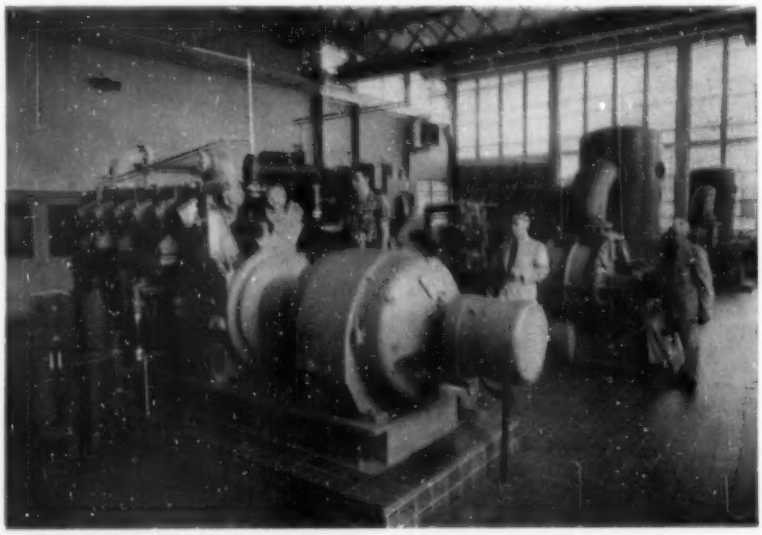
WADE G. BROWN,
City Sanitary Engineer, and
Assistant Superintendent
Water and Sewer Department
Durham, North Carolina

MAKING use of the combustible gas evolved in the process of digesting waste solids has intrigued both engineer and layman for many years. Our knowledge of this subject and the availability of much dependable equipment enable us to evaluate each situation satisfactorily and to design soundly.

In the past, economic factors have been the principal concern, and though they are still important, other factors must be given equal or superior weight. The most important engineering and legal consideration today should be absolute continuity of required waste treatment. At one time, breakdowns and power failures may have been accepted as inevitable, and the resultant inadequate waste treatment was considered a necessary evil, but this is no longer true. In my experience as a witness in more than thirty lawsuits alleging nuisance from waste discharge, no defense pleadings based on economic reasons were allowed. This emphasizes the importance of the development of sludge gas utilization facilities to back up outside sources of power.

The economics of sludge gas utilization have changed considerably in the past thirty years. The cost of electric power has decreased steadily, and with nuclear power and ultrahigh voltage transmission in the future, the trend promises to continue. Although power outages are less frequent today, we know that the forces of nature can immobilize us; one of Durham's plants was without power for four days in October, 1954, because of Hurricane Hazel. We now have two dual fuel Diesel generator sets at that plant. Sludge gas engines are now more dependable, however, as well as somewhat more efficient, and maintenance costs have dropped in spite of higher labor and materials costs. Durham now operates five such engines with the original installation of two engines made in 1933.

Although it may be more difficult to justify for economic reasons the development of sludge gas for power production in the future, the provision of prime or standby power to assure continuity of treatment requires that in all but the smallest plants sludge gas be used for this purpose.



● **ENGINE ROOM of the Northside waste treatment plant, Durham, N. C. Entire piping system is color coded following ASA standards—warm colors for dangerous materials and cool colors for safe materials. In the foreground is a 235-hp Climax engine driving a 175-kw Electric Machinery Co. generator for standby power; middle and background are two 150-hp Cooper-Bessemer engines with Roots-Connersville positive displacement blowers. Space is provided for the installation of a future engine. At left is J. S. Welch, chief operator; the author; and at right, P. D. Davis, partner of Piatt and Davis, Consulting Engineers for the Northside Plant.**

Composition of Gas

It cannot be emphasized too strongly that each waste treatment problem is an individual one, and every effort must be made to accumulate maximum data and to evaluate such data competently and carefully. There has been too much "rule-of-thumb" designing, too little appreciation by the engineer of basic biological principles.

The nature and quantity of sludge gas will vary with the locality, and within the same plant seasonally and over a period of years. Usually such variations fall between reasonable limits, but we must take into account such factors as the seasonal operation of a cannery, which may increase gas production 100 percent or more, or the existence of a collection system with high infiltration, which may decrease production severely.

The first step in design studies should be the enactment of an ordinance setting forth what may and may not be discharged into the sewer system (2). The principal effect of such regulation, insofar as sludge gas is concerned, will be to limit the discharge of sulfur compounds and give reasonable assurance that hydrogen sulfide production will be within safe limits—approximately 25 grains per 100 cubic feet or less.

When sewage solids are digesting properly and acid conditions do not exist (95 percent or more of sludge

is undergoing third-stage digestion), the gases produced are principally methane and carbon dioxide, with small quantities of other gases, such as carbon monoxide and hydrogen. Methane content will vary from 60 to 70 percent by volume with the remainder largely carbon dioxide. The gas should be presumed to be saturated with water vapor.

The fuel value of sludge gas varies normally from 600 to 700 Btu per cubic foot gross. Data obtained from a continuous recording calorimeter for approximately ten years at the Durham Northside plant substantiated this variation, although day-to-day changes are insignificant. The gas produced by our second-stage digester had a higher heat value—650 to 700 Btu, gross.

Quantity Produced

The volume of sludge gas produced is extremely variable, and sound design practice requires careful study and evaluation of many factors. The nature of the community and its supporting economy are important. For example, a better-class residential community is apt to have a much greater number of garbage grinders, which can result in a significantly higher gas production per capita. An older community will almost certainly have greater infiltration, and lower gas production due to loss of solids during storm flows. Plants serving institutions will often have high vegetable fat discharges and considerable laundry wastes, which tend to raise gas production above normal.

Textile wastes are often high in carbohydrates which decompose anaerobically to form primarily methane and carbon dioxide. Packing house wastes, on the other hand, contain considerable nitrogenous organic matter, which produces little combustible gas when digested (4).

If information and analytical data are available to the consultant, they must be examined critically, particularly as to the competence of the analyst and as to whether sampling has been representative. All too often a complete waste survey will be necessary, with careful sampling over as long a period as is practical.

Published data show gas production to vary widely, from 0.3 cubic foot per capita to about 2.0 cubic feet, with a median range of about 0.8 to 1.2 cubic feet. Unfortunately, much of the published data are not statistically sound, and the designing engineer must be critical of it. For example, all data on gas production per capita should be reported as "per capita equivalent," which is determined by dividing the proper statistical mean BOD in pounds of the raw waste by 0.17. Since few of the published figures are reported thus, it must be assumed that at least a portion of them are too high, no allowance having been made for trade wastes.

Another method of estimating gas production is based on cubic feet of gas per pound of volatile matter (dry basis). In this case the median range appears to be 8 to 12 cubic feet. In any event, the nature of the sludge—i.e., whether it be solids from plain sedimentation, chemical precipitation, trickling filters, or activated sludge plants—affects the production of gas. In general, assuming that the solids are digestible, destruction of volatile matter is apt to be more complete and more rapid with plain sedimentation or chemical sludges, least so with activated sludge, and intermediate with trickling filter solids. Further discussion and methods of calculation are given in the bibliography (3), (5).

Toxic metals, such as copper and chromium, and other wastes, such as mineral oils, may reduce or completely prevent digestion of sewage solids and should be controlled by statute. Other wastes, such as canning wastes or other carbohydrate (vegetative) wastes, may increase production very greatly—as much as 100 to 200 percent above normal.

New problems arise constantly in waste treatment, and because we are dealing with biological processes, more time is required to evaluate properly the solutions to these problems. Garbage disposal, either by means of grinders or discharge at the treatment plant, is one such problem, about which there is considerable discussion. As might be expected, garbage can increase gas production greatly, and the engineer will again have to survey each individual situation. If the contributing population is largely median to high level economically, the percentage of grinders will be high, and gas production will be above normal per capita figures.

In recent years there has been a trend toward the collection and disposal of garbage at waste treatment plants. Garbage must be freed of grit, bone chips, coffee grounds, egg shells, tramp iron, and other indigestible solids, or equipment will be damaged and digesters reduced in capacity, requiring very expensive maintenance. Jasper and Marion, Ind., have had considerable experience with very large numbers of home grinder installations. Ross reports at the Richmond, Ind., Sanitary District, that the extra value of gas produced can pay for the extra costs of garbage handling facilities for disposal in bulk directly at the plant in five years.

Gas Collection and Storage

Regardless of the estimated quantity of gas to be produced, all sludge digestion facilities must provide for the safe collection and disposal of gas produced, and all such gas should be metered even though no major utilization is planned initially. (Throughout this discussion, it should be assumed that very small or "package" plants are excepted from consideration).

Safety must always be our first consideration in the design, construction, and operation of sludge gas utilization systems. If mixed with 7 to 14 parts of air, this gas is explosive (5). When a piece of equipment, piping, or storage vessel is placed in flammable gas service, the air must be replaced with an inert or non-explosive gas which in turn is replaced by sludge gas. This is known as "purging." (The reverse process must be followed when taking such facilities out of service for any reason.) It has been my observation that there has been gross and almost universal failure to observe this elementary precaution. The means are conveniently at hand: the exhaust from an air-compressor engine, or other engine which will stand considerable back-pressure, can be hooked up to the facility to be purged. This is a practical method which we have used in Durham. There is an excellent reference work on purging published by the American Gas Association, which describes this method, as well as others, in detail. This publication should be in every library (6).

A simple portable instrument should always be available for detecting gas leaks and to indicate when purging has been properly performed. One such device, called an "Explosimeter," is made by Mine Safety Appliances Co. We have used their portable Model 2. Sound design today will also include a permanently installed instrument for continuous sampling of atmospheres and detection and alarm when combustible conditions are approaching. Single or multi-station units are available and should be installed in digester control rooms and other areas where gas may collect. Durham has two such multi-station units with central alarm,

manufactured by Mine Safety Appliances Co.

An invaluable reference service for sludge gas utilization equipment, as well as materials and methods is THE SEWERAGE MANUAL and CATALOG FILE, available from the publishers of PUBLIC WORKS Magazine, to which general reference is made as a supplement to this article, since space will not permit complete listing of all equipment available, or details of construction and operation.

Because the process of sludge digestion must be carried out with air excluded, the gas thus produced is confined and placed under slight pressure by means of weighted "floating" digester covers or back pressure mechanically induced with fixed cover digesters. The majority of installations use the floating cover, weighted to produce six to ten inches of pressure, water column.

Fixed covers are not permitted in some states. The engineer should become familiar with those regulations which may affect sludge gas utilization. Pressure vessel regulations are particularly strict in some states.

Floating covers should be so designed as to prevent rotation and oscillation. In addition to the usual manholes and sampling wells, a hatch should be provided large enough to admit a clamshell or orange peel bucket, pumps, and similar apparatus to permit cleaning or repair of digester. Design should allow for snow loads and stresses due to cocking. Floating covers are manufactured by Pacific Flush Tank Co., Chicago Pump Co., Ralph B. Carter Co., Infilco and Walker Process Equipment.

Because of low pressure and the certainty of condensation of water in the gas, relatively large pipe, laid to grade must be used. Condensate traps must be placed at all low points in the system. The so-called "Ten States Standards"— an excellent reference source now under active revision—states: "Gas piping should be at least 2½ inches in diameter and should slope to condensation traps at low points. The use of float-controlled condensate traps is not permitted." (7)

Wrought-iron pipe has proven to be a superior material in sizes to 4 inches, with galvanized steel or cast iron the material of choice in larger sizes. Sections of wrought-iron digester heating coils, installed in Durham in 1933, were removed for inspection twenty-five years later, and, although these coils had undergone considerable stress and deformation, the sections were in excellent condition as evidenced by both visual inspection and metallurgical laboratory analysis. Gas collection piping and heating coils inside digesters are subject to great potential stresses due in part to rising and falling layers of scum, and supports must be adequate. Numerous failures attest to the importance of this consideration. All piping should be pressure tested before being placed in service.

Digesters must have pressure-vacuum relief devices, with close tolerance adjustment to protect the system. Such controls are manufactured by Pacific Flush Tank Co. and Vapor Recovery Systems Co. Pressure is usually set to release at 8 to 12 inches, water column. Pressure controls are also necessary at engines, boilers and heat exchangers, and generally are set at 3 to 6 inches. A waste gas burner should be provided, regardless of whether gas is utilized or not. The burner must be located safely, away from buildings and equipment, and so constructed as not to endanger personnel. The waste gas burner must also have a pressure control set to function at a pressure above that of the gas consuming equipment, but below the pressure set on the system control device on the digester cover. The Ten States Standards (7) state that in lieu of waste gas burners "In remote locations it may be permissible to discharge the gas to the atmosphere through a return-bend screened vent terminating at least ten feet above the walking surface, provided the assembly incorporates a flame trap." However, the engineer is well advised to give careful consideration as to how long his location will remain remote in these times of suburban development! Waste gas burners are manufactured by Pacific Flush Tank Co. and Vapor Recovery Systems Co.

All gas consuming devices of significance—not including minor laboratory use, small unit heaters, etc. —should be metered in addition to the metering of total production from each digester. Production figures are valuable in the operation of the digesters, since a change in rate of production is often the first sign of altered conditions which may require urgent attention. Obviously, production figures are important economically and for future planning. The metering of gas consumers provides the operator with a means of checking equipment efficiency. Meters may be of the indicating type only, particularly with consumption equipment. Rotameters may be used provided head loss is not too great and condensation is drained faithfully.

In addition to rotameters, more conventional metering equipment includes displacement-type meters, rotary-type meters (which can be operated with flow reversed) and orifice plates. The orifice plate is

Courtesy Pacific Flush Tank Co.

● **NORTH POINT sludge treatment plant, San Francisco, with digester capacity of 2,451,000 CF, treats sludge from 1,169,000 people, using two groups of 5 tanks each.**

inexpensive; the plate can be removed quickly and a different orifice substituted and this often may be the meter of choice. All types may be totalizing or merely indicating, and recorders are often used. Material of construction should be highly corrosion resistant, for even though hydrogen sulfide is not present in significant amounts at the time of installation, it may appear in the future. All meters must be provided with drains which must be operated regularly. A by-pass should be installed on every meter.

Pressure should be measured at all points of gas production and significant consumption. Manometers are universally used. In addition to the obvious use, fluttering or pulsation of the manometer fluid generally means there is water in the line.

Flame traps are universally required to be installed ahead of gas-burning equipment and should be installed as close to each piece of equipment as possible. Flame traps should also be installed in lines leading from digesters and gas holders. The purpose of this device is to arrest and stop flame propagation and to stop explosion waves. Flame traps are used in combination with a back pressure regulator and thermal shut-off valve just ahead of waste gas burners not only to protect against flame and explosion, but to insure that only surplus gas is wasted. In other installations, the flame trap and thermal shut-off valve are used. In either case, the flame trap or flame arrester is located next to the source of combustion, backed up by the valve. The flame arrester consists of a stack of aluminum plates forming a grid which is contained in a high-tensile strength cast-iron housing. The thermal valve may be either spring loaded or weighted, and a fusible plug melting at 200 deg. F. actuates either type valve. Flame trap-valve combinations are made by Pacific Flush Tank Co. and Vapor Recovery Systems Co.

Gas storage should be provided when gas is utilized. The holder may be relatively small but, as is the case with other design problems, the amount of storage required depends on operating conditions at each particular plant. The storage vessel compensates for variations in gas production and consumption. Economic factors dictate that the holder be as small as possible, but the necessity for continuous effective treatment requires that the holder be large enough to store a reserve supply when gas is relied on for stand-by power. A holder also maintains the necessary uniform pressure on the system.

Gas holders may be either low-pressure or high-pressure types. The older type, the low-pressure holder, varies in volume as the quantity of gas it contains changes. Because of the weight of the moving parts, there is a certain minimum pressure maintained. This type holder operates at 5 to 12 inches pressure, water column. The high-pressure holder stores compressed gas at 30 to 45 psig usually, but pressure may be much higher.

There are advantages and disadvantages of either type holder, although the trend appears to favor pressure vessels. There are two types of low-pressure holders, the water-sealed vessel, and the piston holder. The former consists of a cylindrical steel tank, open at the bottom, which is submerged in another steel tank full of water and supported by the bouyant force of the gas. A more modern variation of this type holder consists of two or more telescoping sections, or "lifts," which make it possible to use a relatively shallow water tank, the depth of one lift. The piston gas holder consists of a fixed shell with a roof which moves up and down as gas is admitted or withdrawn. This holder is sealed by gaskets impregnated with tar, grease or oil attached to the movable roof. A variation of the piston holder is the Wiggins holder, manufactured by General American Transportation Co., which uses a flexible, impermeable, synthetic rubber-coated fabric to prevent the escape of gas through the annular space between piston and shell. For low-pressure storage, the Wiggins piston holder has attractive features, and has been installed at the Hyperion Plant, Los Angeles, the Owls Head Plant New York City, and elsewhere.

The high-pressure holder may be spherical, which form makes the most effective use of the strength of the materials with which it is constructed, making it the lightest design for holding gas under pressure. Cylindrical holders require a wall thickness roughly twice that of a spherical holder designed for equal pressure, but this type is much easier to fabricate and may be cheaper. Steel pipe sections are being used to store natural gas below ground at better than 5000 psi, with obvious economy of space, improved appearance of site, and lower maintenance, and this may prove to be advantageous in the storage of sludge gas.

The low-pressure holders are simple to operate and relatively cheap to erect, but require considerable maintenance. They are often unsightly, not only because of their general appearance, but because the movable roof often becomes stained and darkened. The high-pressure holders require little maintenance other than painting and are generally of pleasing appearance. This feature may well offset possible higher initial cost. The safety factor required by various national, state, and municipal codes limits the pressure to about two atmospheres gauge in most cases in order to avoid the necessity of using extra metal in the shell. The engineer should determine local code requirements before specifying pressure vessels.

Pressure vessels must be equipped with a safety valve located directly on the shell, backed by a plug valve to permit inspection, cleaning, and repair of the safety valve. The safety valve should be equipped with a packed lifting lever for periodically testing the valve and blowing the seat clean.

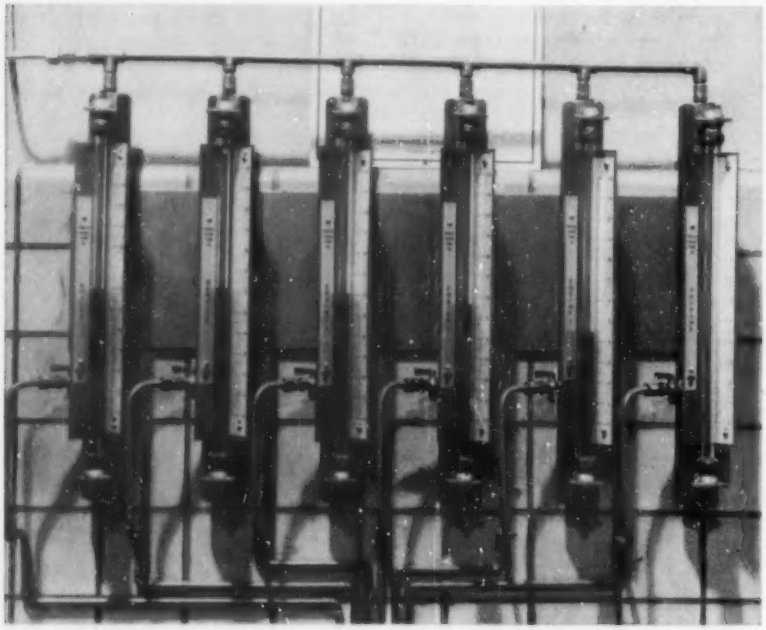
Gas holders are available from Pittsburgh-Des Moines Steel Co., Chicago Bridge and Iron Co., Hammond Iron Works and others.

Gas compressors may be of the rotary positive displacement, centrifugal, reciproating or rotary sliding vane positive displacement types. Because of the possibility of gas leakage through check valves, seal water, etc., all electrical apparatus should be explosion proof. Seal water should be piped outside to minimize this hazard. Vents should be adequate in size and capped to prevent entrance of rain. Compressors should be installed in duplicate or triplicate; alternators are frequently used. Compressors should be made of corrosion resistant materials, since hydrogen sulfide may occur, and the gas is wet. Compressors are offered by Nash Engineering Co., Yeomans Brothers Co., Allis-Chalmers Mfg. Co., Roots-Connersville Blower Div., and others.

Gas Recirculation

The compression and recirculation of sludge gas through a primary stage digester while not a consumptive use, appears to be of considerable economic importance if the benefits indicated are borne out by more extensive experience. Both the Catalytic Reduction Process (CRP) and the PFT-Pearth system embody this principle with certain variations, but the advantages claimed are similar: Reduced diges-

ter capacity because of more complete and more rapid digestion (and therefore more gas). The application of both processes is relatively new, although a number of installations have been made. Durham has installed the PFT-Pearth system at one plant, but not enough data are available for proper evaluation. The engineer should give careful consideration to the advantages of this "use" of gas in future installations, as a means of economically increasing the capacity of existing digesters. The Catalytic Reduction Process is offered by Chicago Pump Co., and PFT-Pearth System is sold by the Pacific Flush Tank Co. The Ralph B. Carter Co. is licensed to furnish gas recirculation systems under the so-called Pearth patents.



● **GAS PRESSURES should be measured at all points of production and significant consumption. This shows the manometer installation at the Durham Northside Plant.**

Use in Engines

If we accept the philosophy that continuity of effective treatment is the most important factor in waste treatment plant design, then we must provide the necessary stand-by power and flexibility. It is tempting to utilize sludge gas in a variety of ways, but its use for such purposes as building heating, air conditioning, or refrigeration, with fixed consumption may jeopardize the more important requirements for waste treatment. Thus again each case will require individual analysis with varying conclusions as to storage and use. This gas may be used for many diverse purposes, such as laboratory use, sludge drying and /or incineration and providing hot water. The removal of carbon dioxide either to raise the Btu content for sale to gas utilities or to reduce storage requirements is not economic.

Stand-by power should be the first concern of the engineer, and an engine generator set the basic equipment. We may wish to use the greater efficiency of an engine linked directly to a pump or compressor, but the greater flexibility provided by electric power dictates the generator as first choice. If sufficient gas exists, consideration should be given to additional directly driven units. Still greater flexibility and dependability may be obtained by specifying dual-fuel engines with an adequate supply of substitute fuel on hand at all times. These dual-fuel engines are relatively new, having come into general use and acceptance since 1945. The stand-by fuel is usually oil, although it may be liquid petroleum or utility company gas.

There are three types of sludge gas engines: 1) The old low-compression, spark-ignition type (Otto-cycle); 2) the high-compression, dual-fuel Diesel which can operate over the entire range from minimum ignition oil requirements (pilot oil) and gas, to 100 percent oil with no gas; 3) the high-compression gas Diesel which operates at all times with only the pilot oil required for ignition of the gas making up the balance of the fuel required.

The Diesel-type engine appears to have definitely supplanted the Otto-cycle engine because of the inherently higher operating efficiency of the high-compression or Diesel cycle. Compression is definitely limited in the spark ignited engine for several reasons. At ratios higher than approximately 13.5 to 1 uncontrolled combustion occurs, while the only limit to compression ratios in the Diesel is the strength of materials of construction. Further, as compression increases in the Otto-cycle engine, it becomes more difficult to produce a spark of sufficient intensity and plugs which will stand up under this high-intensity spark.

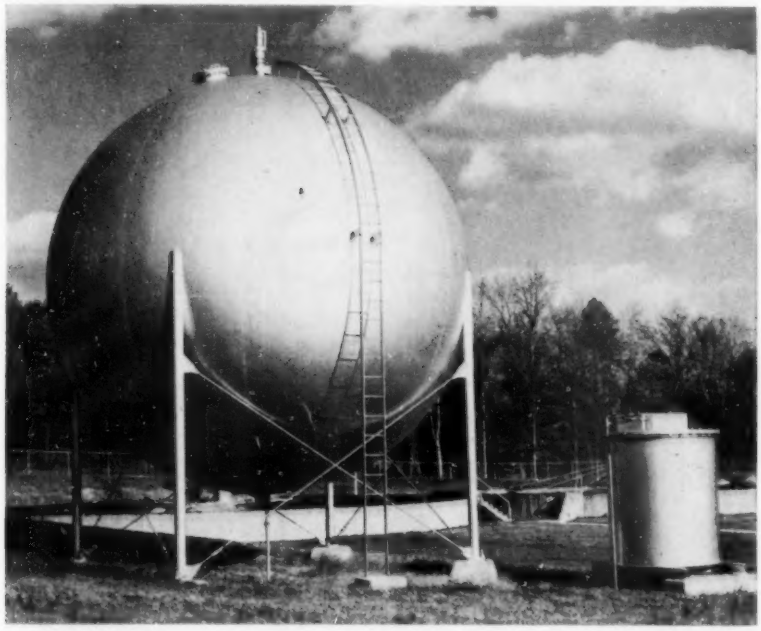
A great deal has been written concerning the pros and cons of these engine types, and considerable disagreement exists among the authorities. This is a specialized field and the engineer should secure expert advice on individual applications unless he is well-grounded in this area. Excellent references are suggested in the bibliography (8), (9), (10).

In order to take advantage of the higher efficiency of the Diesel cycle, it is necessary to inject a small quantity of fuel oil into the compressed air-gas mixture in the cylinder to ignite the charge. The amount of fuel oil necessary to accomplish this is variable; the larger engines may require as little as 4 to 6 percent while the smaller engines may use 10 to 12 percent or more. It must be remembered that these engines are relatively new and operating data are not sufficient to provide more reliable information; development and refinement are being aggressively pursued by the engine manufacturers.

It is well known that the Diesel engine does not perform as efficiently under partial load, and this condition is frequently found in engine-generator sets. The supercharged engine, with automatic throttling of air supply to maintain more constant air-gas ratio, appears to be the engine of choice under such conditions. A further advantage of the supercharged engine is that the power output from an engine of the same number of cylinders, bore, stroke and rpm can be increased about 50 percent, reducing space requirements.

The thermal efficiency of the Otto-cycle engine is about 20 percent as compared with an efficiency of

30 to 35 percent for dual-fuel engines whether supercharged or not. Assuming a sludge gas of 650 Btu per cubic foot, and a theoretical 5 percent of total Btu input as pilot oil, the gas required in a dual-fuel engine is about 11 cubic feet per bhp-hr., or 27 to 30 percent less than in the Otto-cycle engine. Detailed and helpful bulletins are furnished by the manufacturers of these engines, and full information should be obtained before writing specifications. Engines for sludge-gas service are furnished by Cooper-Bessemer Corp., Climax Engine Mfg. Co. (Div. of Waukesha Motor Co.), Enterprise Engine and Machinery Co., White Diesel Engine Div. of the White Motor Co., Waukesha Motor Co., Chicago Pneumatic Tool Co., and Worthington Corp.



● **GAS HOLDERS may be of the low pressure type, operating at 5 to 12 ins. water pressure; or high pressure, such as this one, operating generally at 30 to 45 psig.**

Maximum dependability is of the utmost importance in treatment plant installations, and it is also essential to be able to start up an engine and put it on the line quickly. Compressed air or a conventional battery operated starter may be used; the initial cost of the compressed air system is greater, but it is more dependable and lower in maintenance cost. At one Durham installation, we have had only one starting failure with two engines in 26 years with an air-start system, whereas we have had frequent failures due to battery trouble in other installations despite every precaution and painstaking maintenance. The starting air compressor may be equipped with a combination electric motor-gasoline engine drive. Another very important feature which should be embodied in all plant engine installations is the provision of means to keep all engines "warmed up," at a temperature of about 160 deg. F. This can be done by circulating engine cooling water through idle engines, or using an electric immersion heater in the engine cooling water system, controlled by an aquastat. These heaters are sized according to the cubic inch displacement of the engine and are made by the Kim Hotstart Manufacturing Co. With the engine preheated, not only will it start more surely and full load applied immediately, but maintenance costs will be very greatly lowered, particularly on engines on stand-by basis only. Maximum dependability and minimum down time will require careful and regular maintenance. Full flow oil filters (with by-pass) should be provided; scrupulous attention to engine manufacturer's recommendations for lubrication should be insisted on. Spare parts and special tools should be purchased with the engine, and fuel injection nozzles should be tested regularly with a nozzle tester, such as manufactured by American Bosch Co.

Although waste treatment plants are usually located as remotely as possible, complaints are always possible due to noise or vibration. Adequate silencers must, therefore, be provided, of such size as not to create excess back-pressure. The foundation should be carefully investigated and adequately designed; the engine and foundation are often isolated from the engine room slat. Engine back-pressure is very critical although it has been my observation that minimum attention has been paid to this obvious fact. A tap should be made on the engine exhaust at the exit from the engine, ahead of heat exchangers, boilers, stacks or any devices capable of creating back-pressure. The pressure checked at the time of installation with a manometer to be sure it is within allowable limits. This reading, if safe, should be permanently recorded and repeated regularly during operation of the engine. Excessive back-pressure will not only increase maintenance and decrease reliability because of excessive down time, but it has been established experimentally that for every one-inch increase in water column back-pressure, there is a corresponding loss of one percent in engine efficiency (11). It is apparent that the exhaust disposal system must be carefully designed.

Waste Heat Recovery

With regard to the heat and power value of sludge gas, Powers of the Compressed Air and Gas Institute, says, "Sludge gas-fired hot-water boilers have an efficiency of from 60 to 80 percent, the lower figure being more common. Gas engines have a power efficiency of 20 to 25 percent and a water heating efficiency of about 50 percent. Thus, gas engines are almost as efficient as boilers for water heating, and should be used for that purpose wherever the power requirements of the plant make their installation economical. Taking the net fuel value of sludge gas as about 640 Btu per cubic foot, a gas engine may be expected to yield one horsepower-hour of energy from 18 cubic feet of gas, or one kilowatt-hour of energy from 24 cubic feet of gas. About 50 percent of the fuel value of the gas can be recovered as heat from the engine by using the cooling water from it and a heat-exchanger on its exhaust. This heat can be used either for heating the tanks or for space heating in buildings." (Page 69, *Wastes Engineering* Feb., 1952.) Note that the engine efficiency assumed is that of the Otto-cycle engine discussed previously, and that the Btu assumed is slightly lower

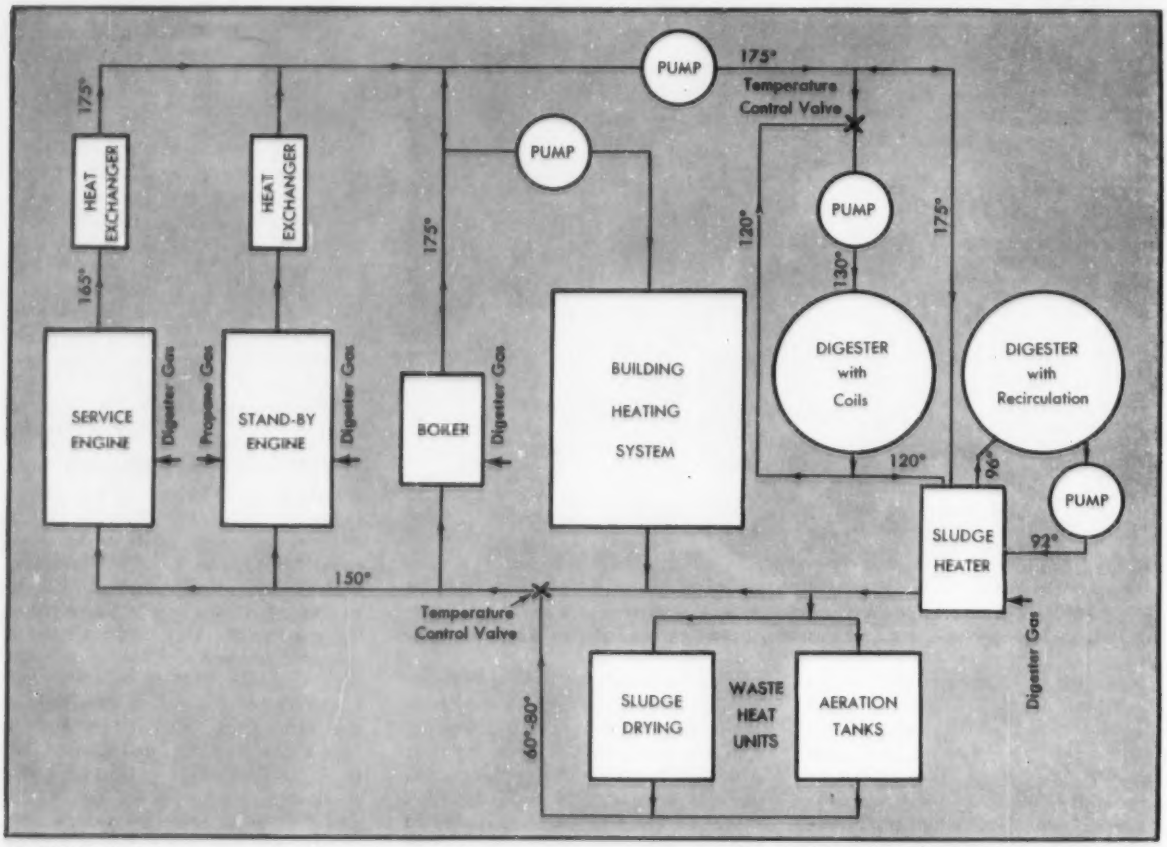
than that used in the example cited in the discussion on engine efficiencies.

It is the water heating efficiency of the engine and the need for such heat in a waste treatment plant that really makes the combined system sound economical. While the dual-fuel engine has emerged as a practical reality, actual engine efficiencies have increased very little in recent years (nor are engine efficiencies apt to increase greatly in the immediate future, so risk of rapid obsolescence is slight). On the other hand, progress in heat engines, to approximately 47 percent of total input in a dual-fuel engine (proof of higher thermal efficiency of these engines). This waste heat can be recovered in the form of hot water or low-pressure steam, and is available for heating digesters, space heating, sludge drying, etc.

The oldest and most common waste exchange device is a so-called waste heat boiler, a simple water tube and exhaust gas flue type boiler, through which engine exhaust and cooling water pass. It is a natural tendency to attempt to scavenge as much heat as possible at this point and to provide a little extra capacity; this is a pitfall for the unwary—not only can excessive back-pressure be created initially, but corrosion may be initiated by condensation in the after section of the exchanger and excessive back-pressure develop as a result, with increased maintenance costs and shorter service expectancy. Instead of overdesigning the waste heat boiler a better method of scavenging all possible waste heat and at the same time improving engine efficiencies in the case of Diesel cycle engine generator sets normally underloaded, is to provide electric water heaters to add heat directly. Such heaters are made by Engineering Controls, Inc., which also makes waste heat boilers and "Vapor Phase" separators where waste heat can be flashed to steam at 5 to 10 psig.

Heating Sludge

The most important waste treatment use of recovered heat is the heating of sludge to optimum digestion temperature, 90-95 deg. F. Methods of calculating Btu require-



● **FIGURE 1. Schematic drawing shows the waste heat recovery-use system installed at the Durham Northside treatment plant.**

transfer technology has been very great. Here again is a highly specialized field wherein expert advice is needed in all but the simplest application.

There are two sources of so-called "waste heat." One is the heat absorbed by the engine cooling water, and the other is the heat in the exhaust gas, which together represent from 60 to 65 percent of the total heat content of the fuel, depending on the type of engine. The amount of recoverable heat ranges from about 52 to 53 percent of the total available in low-compression

ments under varying conditions are given in references (3, (5). Heat requirements for raw sludge may be determined conveniently from a nomograph published by PUBLIC WORKS Magazine, which may be obtained in the form of a reprint of an article titled, "Nomographic Solutions for the Design of Anaerobic Digestion Equipment," by Walter R. Lynn, Oct., 1957. Hot water is piped underground normally, to the sludge digestion facilities. Piping should be well insulated and laid in specially insulated conduit such as that manufactured by Ric-wil Co.,

Johns-Manville, or Stillwater Clay Products Co.

The water used in a waste heat recovery system should be non-corrosive and non-scale forming, and corrective treatment will often be needed, particularly in the case of well water obtained at the plant site. An expansion tank or tanks should be provided at a high point in the system which will level out surges and compensate for changes in volume, and most important, release air from the system. If the system is of any magnitude, automatic air-release valves should be used liberally. Water circulating pumps must be specified for the thermal range anticipated; such pumps are available from Yeomans Bros., Chicago Pump Co., H. A. Thrush and Co., and others. Thermally controlled valves which open and close at preset temperatures may be used in the hot water system to regulate flow to heat-consuming devices. The Fulton Sylphon Div. of the Robertshaw-Fulton Controls Co. makes such valves.

Raw sludge may be heated externally and then added to a digester, now considered the best practice, or added directly to become heated by the digester contents. Preheating prevents shock loading of digesters which causes considerable irregularity in gas production. External heaters are more efficient and repairs to the system can be made without emptying the digester. This is reason enough to favor this system. Countercurrent sludge heaters preheat raw sludge and keep digesters heated by recirculation of digester contents. Hot water from the engine cooling system and waste heat boiler is circulated through these sludge heaters and if this heat is insufficient, it can be supplemented by gas burners incorporated in the sludge heater. A number of heat exchanger-type sludge heaters are available with varying degrees of automatic control. The same safeguards which are standard practice in low-pressure boiler installations should be built into the system. Heat in excess of plant requirements can be wasted by cooling coils in an aeration or settling tank, and controlled by thermal valves. Figure 1 depicts a schematic drawing of the waste heat recovery system at Durham, designed by Platt and Davis, Consulting Engineers. This system has proven very efficient and satisfactory. Four covered sludge drying beds, of conventional construction were piped with ¾" pipe on 6" centers as an experiment. While sludge dried well during the wet season, it was concluded that because of our mild climate and ample space, additional installations were not justified.

External sludge heaters with recirculation features have reduced scum formation in digesters thus maintaining costly digestion tank space, and have stimulated digestion with the result that more gas has been produced. Sludge heaters are produced by the Ralph B. Carter Co., Dorr-Oliver, Inc., Engineering Controls, Inc., Pacific Flush Tank Co., and Walker Process Equipment, Inc., all of whom furnish explanatory bulletins.

The Chicago-Selas heat transfer system heats sludge externally by the combustion of gas in a burner submerged in a sludge-heating tank. The hot combustion gases are discharged into the sludge, producing agitation, and resulting in a highly efficient transfer of heat. Chicago Pump Co. markets a package assembly incorporating this system.

All of the older digesters were heated by a system of coils with circulating hot water, and while there are many of these digesters operating efficiently after many years' service, the difficulties of servicing them makes this practice questionable. It is only in recent years that any number of digesters have been in service long enough to require cleaning out, for one reason or another, and those of us who have had to do this can testify as to the difficulties and expense. Durham has cleaned out three digesters, and our cost has been approximately $3,500 each. But much more important, we have had a vital part of our treatment plant out of service for many weeks. As this type of experience accumulates, I am sure that the majority will vote with me against using any form of heating coil inside a digester.

As an important adjunct to the use of sludge gas for heating sludge, it is important that heat losses from digesters be kept to a minimum. Insulation of walls is important. Many of the older digesters were banked with earth, which has poor insulating qualities. Cellular walls are frequently used, with air space or insulating materials such as Fiberglas.

There is another method of internal heating, however, which again involves direct combustion of sludge gas. The proper mixture of air and gas is fed under pressure sufficient to overcome the static head of the sludge and burned well down in the sludge mass. All heat of combustion is utilized and mixing of the sludge is accomplished by the discharge velocity of the exhaust gas; multiple burners produce uniform heating. Gas within the digester cannot burn because only enough air is supplied the burner to ignite the gas premixed with it. Such burners are made by C. M. Kemp Mfg. Co. and Ozark-Mahoning Co.

Space Heating

The second most common or general use of heat recovered from combustion of gas in engines, as well as direct combustion of gas, is space heating. Hot water may be circulated through conventional boiler tubes, and this heat may be supplemented by gas-fired burners controlled by aquastats. (See Figure 1) Combination gas and oil-fired units may be necessary in colder climates. Unit heaters may be used, and hot water heated for laboratory and plant use. Laboratory burners of all sorts can utilize sludge gas heat. Refrigeration, including air conditioning, can be provided by gas-burning units. Installation specifications would be identical to those utilizing any type of gaseous fuel except that in all cases it must be clearly stated that sludge gas with a Btu range of 600 to 700 will be used as fuel.

Drying and Incineration

Heat drying and/or incineration of digested sludge is another potential use of sludge gas. The purpose may be either to produce a sludge fertilizer or to speed up disposal of the sludge, particularly where land is not available for drying beds. These uses of sludge gas are not economic unless the plant is very large, and a thorough study by competent engineers should always be made before such plans are developed. Large capital investment is required even for a minimum facility. Further, without going into the pros and cons, the development of sludge as a fertilizer by-product is always questionable and should be studied on its own merits. Questions that require careful evaluation are: Potential market including economic shipping radius; local, state and area regulations and attitudes; overhead, such as the continuous laboratory analysis of sludge to meet fertilizer sales regulations; and equipment depreciation costs, which can be high.

Two types of rotary dryers are commonly used, the kiln such as used in the manufacture of lime and cement, and the cage-mill or

(*Continued on page* 182)

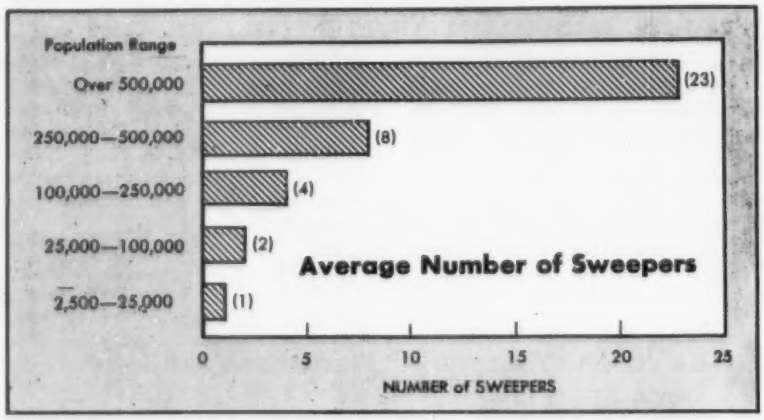
SWEEPING CITY STREETS

IN A SURVEY of city engineering activities, completed in the Spring of 1959, PUBLIC WORKS Magazine collected information on street sweeping operations from city engineers, directors of public works and city managers. Questions asked included the number of pickup sweepers used by each city, the average number of curb miles swept per day, and the cost per curb mile for labor and equipment.

A total of 1080 replies were received in response to the question on the number of street sweepers owned and operated. The accompany chart shows the average number of units owned and operated by cities of various population range. For the purpose of this tabulation, New York City, which operates over 300 sweepers, was not included in the averages.

The answers on the average curb mile swept per day and the cost per curb mile for labor and equipment were varied and inconsistent and no definite conclusions could be found. Accordingly, the Editors of PUBLIC WORKS Magazine wrote to several cities throughout the United States for more detailed information on these questions, plus how the costs were calculated.

Their replies are listed in the following paragraphs.



● **REPORTS from 1080 cities show how number of sweepers used varies with population range. New York City has over 300 sweepers and was not included in average.**

OAKLAND, CALIFORNIA

As reported by **JOHN A. MORIN, Supt. of Streets and Ex-Officio City Engineer**

At present, the City of Oakland has in service 7 mechanical sweepers consisting of 5 Elgins, 1 Mobil and 1 Hydropower with the Mobil and the Hydropower being used mostly in the "Hill" districts. However, throughout the year, these 7 sweepers are not used in full force at any time. A monthly report indicates that a total of four or five machines are used per day and night shift contingent on mechanical repairs and seasonal fluctuations in work loads. An average computed from these monthly reports shows 4.6 sweepers used during a year's time.

During this period, three machines were operated each night shift whereas, one to two machines were operated each regular daytime shift, hence, the average of 4.6 machines operating per day.

An averaged breakdown of these monthly reports for the fiscal year 1958-59 are as follows: 26,349 curb miles per year; 2,196 curb miles average per month; 252 working days per year; and 21 working days per month average. From the above averages, the following averages are computed: 105 curb miles per 8-hour shift average; and 23 curb miles per machine per 8-hour shift average.

● **THE City of Oakland manufactures their own replacement brooms. Last year 155 main brooms and 141 gutter brooms were needed. Broom replacement costs in Oakland were 41¢ per curb mile swept.**

Total cost per year of 7 sweepers is $20,531.16; cost per machine per 8-hour shift $23.08; cost per operator per 8-hour shift is $21.26; total cost of operator and equipment per 8-hour shift is $44.34; and total cost per curb mile is $1.93 for both operator and equipment.

A total of 155 main brooms are used requiring 11,625 lbs. each of Palmyra and Hickory reeds at a cost of $0.128412 per lb. of Palmyra and $0.144612 per lb. of Hickory or a total cost of $3,173.90 per year. A total of 141 gutter brooms required 10,152 lbs. of flat steel wire at $0.360612 per lb. at a total cost of $3,660.93 per year. All material used in the manufacture of brooms includes a 4 percent State Sales Tax.

All brooms are manufactured by one full time employee. Each main broom averages $20.48 plus $15.41 for labor for a total of $35.89. Use of each main broom averages 168 miles and costs 21¢ per mile. Each gutter broom averages 213 miles and costs 20¢ per mile. The total cost per curb mile of both brooms is 41¢. The City manufactures on the average not less than one broom per day.

The cost averages per machine sweeper in terms of cost per curb miles is $2.34. This figure is based on actual cost to the City. Insurance, depreciation, etc. has not been included.

MINNEAPOLIS, MINNESOTA

As reported by
ELMER H. LUND,
Supt. of Streets

Minneapolis has 14 sweepers which include 7 Mobil, 6 Wayne and 1 Gutter-Snipe. The Equipment Department furnishes all sweepers and operators to the Street Department at a pre-determined hourly rental rate that includes all direct and indirect charges for operation, maintenance, repairs and replacements.

An average of 13 sweepers are used per day and they will cover about 312 curb miles per day at a total cost of $1,289.60 or $4.13 per curb mile.

The cost per curb mile is calculated as follows: Rental of 1 sweeper per 8 hours is $99.20; filling the water tank 6 times @ 5 minutes each is ½ hr; dumping debris 12 times @ 5 min. each is 1 hr.; traveling time and mechanical adjustments takes ½ hr.; actual sweeping time is 6 hrs.; recommended sweeping speeds is 4 mph; 4 mph @ 6 hrs. 24 curb miles; and the cost per curb mile is 24 curb miles ÷ $99.20 rental rate or $4.13 per curb mile.

● **SWEEPERS used by Minneapolis include these Wayne (top) and Mobil machines.**

OCALA, FLORIDA

As reported by **R. BICKERTON, Superintendent of Public Works**

Ocala, Fla., has one sweeper and this machine is operated 12 hours per day, five days per week. The average mileage covered each month is 378 and the average monthly collection is 266 cu. yds. The average monthly maintenance cost is $126, which includes gas, oil and grease and the cost of labor per month is $536.19. The average cu. yd. of sand collected per mile costs 74¢. The average cost per mile is $1.75 and average cost per cu. yd. of material is $2.50.

Leaf and Spanish Moss deposits along with the sand result in difficult sweeping problems. The leaf drop is usually spaced over a three to four-month period depending upon the weather and tree types while the moss problem is always a factor. The brooms are rewound with Hickory and give from three to four weeks wear.

ALHAMBRA, CALIFORNIA

As reported by **R. G. BEZZANT, City Engineer and Street Superintendent**

Street cleaning cost and data in Alhambra, Calif., are broken down as follows: Sweeper miles average 1761 per month; cost of picking up sweeper piles per mile is 46¢; cost of all other cleaning and refuse per mile is 74¢; and cost of sweeping only which includes the broom material is $1.16 per mile. Total cost for all operations averages $2.36 per mile. Alhambra's four sweepers cover over 20,000 curb miles per year.

● **POSTER on this street sweeper promotes the local clean-up campaign.**

EAST LANSING, MICHIGAN

As reported by **ROBERT M. BRUCE, City Engineer**

We have one Mobil sweeper which is now equipped with a Danline steel broom and we have found that both the conveyor type sweeper and the steel broom have helped to reduce costs of operation.

Since the purchase of the conveyor type sweeper the life expectancy of our fiber brooms has increased from 65 miles to 150 miles.

The addition of the steel broom has shown promise of providing additional savings and convenience. We now have 650 miles on the broom and it appears to be about one-half worn out. This means savings in the cost of materials and labor and also, eliminates much "down time" on the

sweeper. This "down time" becomes particularly important when a City has only one sweeper.

We operate all equipment on a revolving fund and charge a rental rate that is established by the Michigan State Highway Department. This is necessary as we have contracts with the Highway Department to maintain State Trunklines through the City. These rental rates provide for maintenance and replacement of equipment and also provides for the overhead of garage operation.

The cost per mile of sweeping is as follows: 10.5 hours sweeper use @ $5.80/hr. is $60.90; and 12 hours operator @ $2.02/hr. is $24.24. The actual sweeping cost per day is $85.14, and with an average of 35 miles swept per day the average cost per mile is $2.43.

The cost of picking up sweepings is as follows: 3 hours with truck and Lodal @ 3.20/hr. is $9.60; and 2 men or 6 man hours @ $2.00/hr. is $12.00. Total cost of pick-up per day is $21.60 with the cost per mile swept being 60¢. The total cost per curb mile is $3.03.

GRAND JUNCTION, COLORADO

As reported by **R. E. CHEEVER, City Manager**

The following is a list of costs and data for street sweeping in Grand Junction, Colo.: The average curb miles swept per day is 20; the average load per 8 hours is 15 cu. yds.; cost per curb mile, labor and equipment is $4.18 which covers the labor cost based on an equipment rental charge which pays for maintenance and all new equipment; 90 hours of sweeping cost $600.14 for gas, oil and parts; $25,000 was budgeted for sweeping in 1958 and the amount spent was $21,959.50; and in 1958 5,257 curb miles were swept.

In March of this year an Elgin Street King complete with four Dempster detachable hoppers were purchased. This equipment is proving to be very successful.

With the old operation, the load would be dumped at 8 am in the morning; two men with a truck would start out and using a front-end loader it would be an all day's job. However, with the new sweeper, sweeping is done in two 8-hour shifts using the hoppers. Extra hoppers are located in convenient places throughout the city. Then the hoist truck goes out in the morning and in little over an hour it has loaded all of the hoppers that were filled during the 8 hours of sweeping.

The cost data will be more complete after another year of operation with our new sweeper.

● **NEW equipment used by Grand Junction: An Elgin "Street King" with detachable Dempster hoppers. Empties are spotted at convenient locations by the hoist truck.**

TENNANT DEVELOPS ROBOT SWEEPER for the AIR FORCE

A 10-TON remote-controlled modification of its vacuumized municipal sweeper has been developed by the G. H. Tennant Company, Minneapolis, for the Air Force Special Weapons Center.

The uncanny riderless machine, developed for decontamination sweeping, reportedly can be observed, guided and controlled by radio-TV circuits 5 or 10 miles away from the sweeper.

Covering a 7¼ ft. path, the new unit sweeps at speeds up to 35 mph, has a capacity of 4 cubic yards, and is said to have "an anticipated capability of 99 percent or better in pickup of fallout debris or runway soilage."

In emergencies, Air Force officials say, the sweeper would use two or three TV cameras (with zoomar lenses) for the "eyes." The operator, safely hidden from radioactive hazards, would observe and guide the sweeper's progress while watching corresponding TV receivers in front of him.

In demonstrations before Air Force, Civil Defense and health authorities recently in Minneapolis, the sweeper started up, turned, reversed, shifted gears, swept and dumped—all by remote control from a 12 by 15-in. panel held by engineers 60 ft. away. Radio circuits will be used for remote control in tests now being conducted at various Air Force bases.

While designed for emergency use, the Air Force plans to use the prototype for routine sweeping of jet aprons, taxiways and runways. The machine can be switched from manual to remote in a few minutes.

To attain the "estimated 99 percent pickup" the sweeper uses an 87-in. vacuum-enclosed broom, air jets, and a special vacuum system including a dust filter with over 1,000 sq. ft. of filter area.

Snow and Ice Control
ON COUNTY HIGHWAYS

LAWRENCE F. WAGNER,
Ocean County Engineer,
Toms River, New Jersey

AT 3 AM. last December 11th the watchman at the Ocean County Garage made his hourly inspection of the weather. He observed that the rain, which had been falling all evening, had changed to sleet and snow. Seeing the condition and knowing the weather forecast, he immediately started in operation the prearranged plan for snow and ice control on the 620 mile County Road System.

The watchman began by telephoning 20 road foremen in the different sections of the County. He informed them of the weather conditions that existed and that the snow was expected to accumulate to a depth of about 2 inches. The watchman had been in contact with the New Jersey State Highway Garage in Ocean County where the weather report was received from the headquarters in Trenton.

The Foremen then mobilized the truck drivers and helpers under their jurisdiction. Shortly after 4 am some 62 trucks equipped with 10-ft. wide reversible straight snow plows, manufactured by the Gledhill Road Machinery Co. and the Good Roads Machinery Corp., began moving in various sections of the County.

The trucks on which the snow plows were mounted were of various manufacturers including Chevrolets, Dodges, Fords, GMCs and Internationals. Each truck was operated by a driver and a helper. The trucks were equipped with flashing beacons, tire chains, tow chains, a snow plow, torches and miscellaneous tools as needed to meet most any emergency; 25 of the trucks were equipped with Jet Queen spreaders, made by Good Roads Machinery Corp., in addition to a snow plow. The County owned 40 of the trucks, the remaining trucks were rented from local contractors. Each truck had a prearranged section of the County Road System to patrol approximately 10 miles in length.

● **HEAVY drifts call for the use of V-Plows mounted on motor graders.**

The snow plows commenced plowing after 1½ to 2 ins. of snow had fallen. It was important to begin plowing early in the storm before the snow became packed by traffic. The plows removed the snow to the outer edge of the travelled roadway and down to the surface of the pavement.

Where ice had formed on the roadways the trucks equipped with the spreaders began treating the surface of the pavement with sand as an abrasive. The most dangerous points including sharp curves, hills, railroad crossings, road junctions and bridges were treated first. This sand from covered stock piles contained 50 to 75 pounds of calcium chloride per cubic yard and each truck held 5 cu. yd. of material. The stock piles located at central locations and branch garage yards were prepared earlier in the fall and the material was loaded onto the trucks with front end loaders. The loaders are Pippin, Ferguson, International, Fordson and Pettibone-Mulliken.

Use of Salt

Along a few of the main County Roads and in some towns salt was spread at the rate of 400 to 600 lbs. per mile on a 30-ft. wide roadway. This tended to prevent the packing of the snow and freezing to the pavement, making plowing easier where necessary. The use of salt will eliminate the necessity of spring clean-up. The use of salt at limited locations proved very satisfactory not only from our view point but from the public. This year approximately 200 tons of salt were used at a cost of $20.40 per ton delivered. In the future we plan to expand this portion of the work.

As in other years the County let a contract for the furnishing of calcium chloride and salt. The calcium chloride was furnished by the Solvoy Process Division of the Allied Chemical Corporation and the salt was furnished by Charles Schaefer Sons, Inc.

By 7 am the roads were in a condition safely to handle the traffic in all sections of the County. Later in the morning the snow ceased and the first storm of the season was under control.

A day later another storm developed in the Midwest and it struck Ocean County after midnight on December 13th. Once again the role of the night watchman observing the start of the storm paid off. This time the predicted snowfall was 8 in. with strong northwest wind to follow the passing of the storm. Again the fleet of equipment rolled into motion.

In addition to the snow plows mounted on trucks, 5 motor graders with V-Blades were added to the fleet to work in areas where the snow began to drift. The graders consisted of 12 and 15-ton Adams, Galions, and Huber-Warcos.

Control over the operation was maintained by Charles H. Cox, the County Road Supervisor through the use of the County's two way radio communication system. One master Motorola Station located at the County Garage in Toms River, the geographical center of the 640 square mile County, was able to communicate with 22 of the County's trucks equipped with Motorola Communication Sets. In remote sections of the County messages were relayed through sub-stations in the County Garages at Van Hiseville and at Ship Bottom.

In addition to the mobile units a portable set was held in readiness for use in an emergency situation. Another set was located in the Court House at Toms River and made pos-

sible direct communication with the County Garages and other units. The entire radio equipment installed by Motorola cost approximately $15,000. The use of radio communication greatly facilitated the coordination of the snow removal and ice control operations. The mobile and fixed stations assisted in the rapid dispatching of equipment, the reporting of adverse conditions, and the general control of operations. The communication system has been a very profitable expenditure for the County.

During the storm several automobiles in distress were encountered. The snow plow trucks equipped with skid chains and tow cables were able to render assistance and get the motorists back onto the cleared roadway. This service greatly expedited the flow of traffic.

Five mechanics were available to go out to make emergency mechanical repairs on the snow removal equipment. They used pick-up trucks for their tools and transportation. Despite the usual spring and fall maintenance on the equipment, failures did occur.

Snow Fences

In the early afternoon the snow stopped but the crews of workmen had to continue operations because a strong northwest wind continued to form drifts at locations not protected by snow fences. Snow fences were set last fall parallel and distant 60 to 100 feet from the edge of the road in areas where previous observations showed that drifts constantly formed. The fence changed the velocity of the snow-laden wind so that the snow was deposited before it reached the roadway. It had been erected on private property with the consent of the owners and is put up and taken down when it least inconveniences the owner. The snow fence was manufactured by Lincraft-Inc. and consisted of 1½-in. slats, 4-ft. long, spaced on 6-in. centers, and supported by 7-ft. steel posts 10-ft. apart.

Some crews of workmen were dispatched to remove snow in business districts in the towns. Front end loaders and belt loaders were used to load the trucks. The loaders were manufactured by Athey Products Co. and Pettibone-Mulliken Corp.

A 24-hour work schedule remained in effect until all the main County Roads were passable and until the fury of the storm abated. The men received overtime wages and were paid for the meals eaten during the storm.

The County Road Department was complimented by the public for the work which they performed during this storm. It was accomplished because each foreman and his crew of men were instructed in their duties in the fall of the year. Both group and individual instruction was given by the Road Supervisor and his Assistant. In fact, the Freeholders of the County sat in on one of the sessions, offered several valuable suggestions, and helped to arrive at conclusions on various policies of procedure.

Municipal officials were urged to check all road and snow removal equipment and to place it in first class working order. They were asked to provide at least one 4-wheel drive vehicle for emergency deliveries of fuel and food to isolated families. They were also asked to enforce "No Overnight Parking" in streets to facilitate snow removal.

The motoring public was asked to check all motoring equipment, such as chains and snow tires, and be equipped with a shovel while traveling. Citizens were urged not to request removal of snow from driveways, since County equipment cannot operate on private property unless in an extreme emergency. Phone calls to the Road Department hinder the progress of snow removal more than they help. Requests by citizens for aid should be directed to local municipal agencies. Municipal self help was the key to extending the total effectiveness of fighting the winter weather.

Suggestions for the Public

The County Publicity Department aided in the snow removal problem by telling the public of the snow removal problem. Through the local newspapers suggestions were offered to the public on how to cooperate. One article indicated how private property owners should remove the snow from their driveways by placing the snow on the right hand side facing the street. In this location it would not be thrown back into the driveway when a snow plow came by. Another article warned motorists to remove their automobiles from the travelled way at the beginning of storms to prevent interference with the snow plows.

The winter of 1958-59 started out with these two storms. The rest of the winter was free of snow storms. In all only 10 ins. of snow fell this season, whereas 56 ins. had fallen the previous year. Regardless of the amount of snowfall, a well organized Road Department is necessary to cope with snow and ice control on County Highways.

Radiation Monitor for City Water Supply Systems

A monitoring system designed to keep constant check on traces of radioactivity will be installed in the Philadelphia water supply. Two units costing $7,000 each are expected to be put in operation this year. The purpose of the system is to keep an accurate record of minute radiation and to detect significant increases. It will perform round-the-clock monitoring and recording beta and gamma levels.

Each unit is housed in a seven-foot-high cabinet, and was developed from similar devices made by the Victoreen Instrument Company of Cleveland to check contamination of water in Atomic Energy Commission installations with nuclear reactors.

The new equipment is connected into the water supply at one or more key points, so that its crystal detector is exposed to the flow at all times. The detector is housed in a heavy stainless steel-lined three-inch lead shield, to exclude normal atmospheric radiation. Water flows through the housing continuously. Trace amounts of radioactivity generate a signal which controls the marking-pen on a chart. The equipment incorporates an analyzer which makes it possible to identify a particular contaminant in the flow.

The equipment automatically checks itself every two hours. A tiny particle of strontium-90 is edged into place near the detector at this interval, and will produce a reaction of known quantity if the device is registering accurately. Absence of this bulge on the strip chart recording at two hour intervals would immediately indicate a failure or malfunction, and set off a bell or other aural alarm to warn system operators.

WESTCHESTER COUNTY SPEARHEADS TREND TOWARD NEW DIRECTIONAL SIGNS

ARTHUR FREED,
Traffic Engineer,
Westchester County Department of Public Works,
White Plains, New York

WESTCHESTER County is one of the first counties in New York State to initiate an entirely new signing program subsequent to the adoption of a new state sign manual in July, 1958.

In accordance with the manual, large reflectorized directional signs with silver letters on a green background are being installed on our 145 miles of county roads. All traffic signs will be reflectorized, both message and background, during this signing program, which will require approximately seven years to accomplish.

Old, wooden directional signs, with three-inch black letters painted on white arrows, had become potential traffic hazards and a constant source of irritation to motorists who often had to stop in an intersection to find the directions they required.

For many years, as many as 16 of these non-reflectorized wooden arrows were mounted on a single sign post; they were virtually impossible to read even at moderate road speeds.

With the rapid increase of traffic volumes and speeds, these old-fashioned signs probably were responsible for several accidents involving confused drivers.

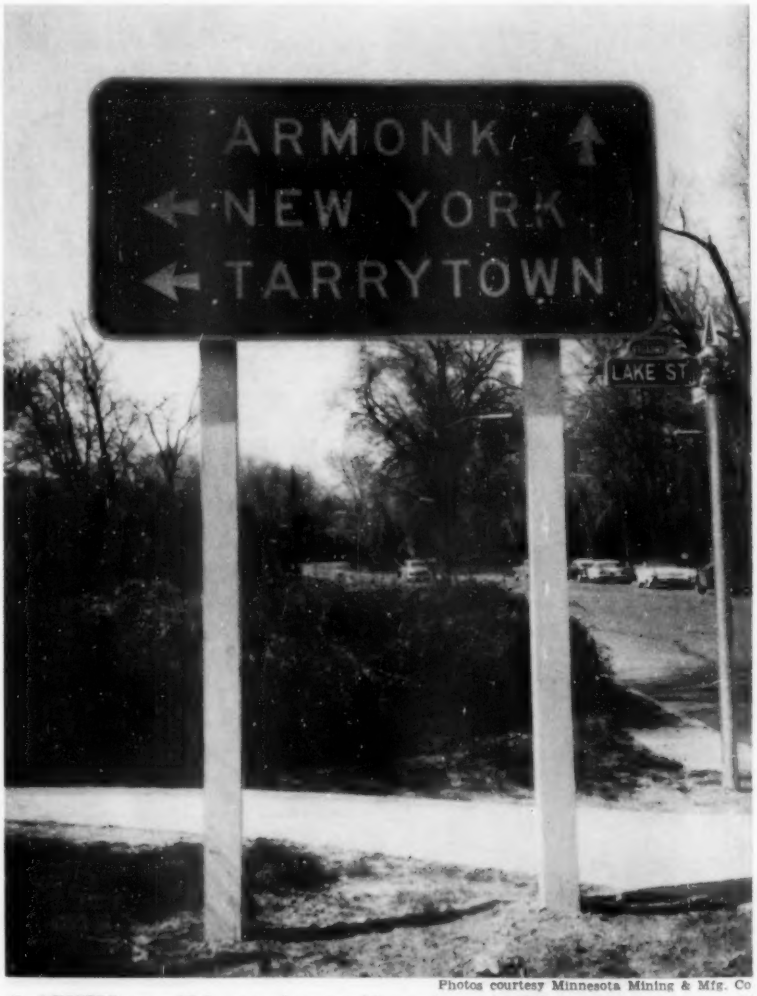
The size of each of the new directional signs is determined by computing the length of the longest line of copy. Six and eight-inch letters are used, with national standards of width and spacing applied. Under unusual circumstances, and occurring very infrequently, four-inch letters have been used.

Most of the signs have a background of 36 sq. ft. Contrary to the initial thoughts of many, a sign of this size can be installed on any highway if sufficient attention is given to proper placement and occasional clearing.

In addition to standard locations, signs, with the lower edge a minimum of seven feet above the ground, have been mounted over sidewalks, cantilevered from embankments, and hung from bridges. Several overhead installations on aluminum or steel structures are scheduled for completion this year.

A commercial firm manufactures the signs, with installations being made by County crews under the direction of Vincent S. Wroniewicz, Supt. of Road Maintenance. Four-by-four-inch or six-by-six-inch timbers set in four feet of concrete are used for all ground mounted signs.

The signs are constructed of wide-angle flat-top reflective sheeting bonded to a back of 0.125-in. acid-etched and degreased aluminum.



Photos courtesy Minnesota Mining & Mfg. Co

● **LETTERS are widely spaced to provide maximum legibility and facilitate rapid reading. Two or three names appear on most of the signs. Arrows are clearly defined.**

● **OUTMODED** wooden directional signs are hazardous and irritating to drivers.

● **BRIDGES** are used whenever possible for mounting directional signs, eliminating the necessity for special supports. The mounting is done by maintenance crews.

Bid specifications are stringent in setting forth the requirements for fabrication and to insure proper handling of the metal and a waterproof bond between sheeting and aluminum.

Sixty-four of these signs will be placed this year. When the program is completed, approximately 700 will have been erected on the Westchester County road system.

Readable at a minimum distance of 300 feet, these signs bear no more than three destination names spaced widely for easy legibility. Residents of the county have commented repeatedly on the ease with which the new directional signs may be read. Brightly visible in the same shape and color in headlights at night, the signs have eliminated confusion previously caused by outmoded wooden arrows.

An indecisive motorist is a living accident potential. He slows down, or stops, or even backs up to regain proper direction, and thereby creates a very basic accident problem.

If motorists receive proper directions, they do not become lost and angry. Ultimately, good signing, as well as proper traffic control, promotes the economic well-being of the community.

Success of business operations within the county depends upon the ability of people to reach these establishments easily. Initial investment is readily balanced by the increase in trade experienced as more motorists can reach more places, with less confusion and less delay.

Through this sign program we are attempting to fulfill another facet of what we hope will be a rapidly expanding shift toward the positive, rather than the negative, approach in the control of traffic. Given adequate information of what he can do, rather than constant notice of what he cannot do, the motorist gains a better understanding and complies with all traffic laws.

Under James C. Harding, commissioner of public works, major highway construction currently is being carried out in Westchester County. These modern primary roads will be marked with traffic signs of the best quality, for we believe each individual who drives through the county deserves the best possible aid we can provide.

ROADBUILDING THROUGH HILLS of CLAY

C. B. LAIRD,
Chief Construction Engineer,
Michigan State Highway Department

U. S. Route 45 in Michigan, begins in the town of Ontonagon on Lake Superior, goes southeast to Rockland, and then turns south toward Wisconsin. Beginning at the turn and running south for eight miles, the existing highway is a 22-ft. wide gravel road. This section, which crosses the Military Hills and the Ontonagon River, is being replaced with a 24-ft. bituminous highway.

The western end of Michigan's Upper Peninsula is regarded by contractors and engineers as one of the state's most troublesome roadbuilding areas, mainly because of soil conditions. Geologists say that much of the area was once the bottom of a great prehistoric lake. When the water receded it left exposed a great plain of dense, plastic clay. In time, forests grew, streams developed, and the land gradually assumed its present appearance. But underneath it all, the clay remains.

The Military Hills are two huge lumps of such clay, of a variety known as Ontonagon clay, named for the county where it predominates. This clay is a reddish paste, with tremendous capacity to absorb and retain water. In its natural state it is always wet, except perhaps for the top few inches which sometimes dries into a hard crust, effectively sealing it.

The hills are, in fact, semi-fluid. Their surfaces persistently move downhill, especially in wet weath-

er. Fissures often appear on the hillsides, evidence that the ground, forest and all, is slipping. The speed of the motion can be anything from an imperceptible creep to a quick slide. Either way the clay is seeking its natural angle of repose, which is a slope of about 3 to 1.

Between the hills the Ontonagon River flows west in a 350 ft. valley it has cut for itself. The valley is much too wide for a bridge, so any road here must descend one hill, cross the river, and ascend the other hill.

It is on these winding ascents and descents where the unstable soil causes the most trouble. The road is endangered by slides both above and below it. Maintenance costs have been tremendous.

The river causes its share of trouble, too. Log jams sometimes form from the vegetation sloughing off the slopes. Or in the spring it may be an ice jam. The hills, already saturated, shed rain like the roof of a house. The river and a tributary, Sandstone Creek, can change almost instantly from quiet streams into roaring torrents, chewing at their banks and battering the bridge. At least one earlier bridge was washed away. The present bridge, soon to be supplanted, has had to withstand floods which put its deck 5 feet under water.

With all these problems, it is reasonable to wonder why a road should even be here in the first place. The answer is that U. S. 45 provides the best and most direct access to some of Upper Michigan's greatest assets. State Route M-26 ties onto U. S. 45 at the Rockland turn and runs out onto the Keweenaw Peninsula. This is Michigan's copper country, which has great economic value and is also a delightful vacation area. There are the Porcupine Mountains, the country's largest state park, and Isle Royale National Park in Lake Superior. Without U. S. 45, north-south traffic into this part of Michigan would be denied direct access.

When John Mackie became Michigan State Highway Commissioner in July 1957, one of his first decisions was to pave all sections of Michigan's state trunkline highways that were still surfaced with gravel. This meant priority for a new road across the Military Hills, since the old route was obviously too steep and winding for safe travel.

Rock for Fill

But there was still the old problem of the soft, sliding clay. To overcome this, the new road is being built on a foundation of waste rock from copper mines. More than half a million cubic yards of the rock will be used. It will go into a trench, widest at the bottom and up to 30 ft. deep. The trench is being filled with rock up to grade level and then the roadway will be built on top of it. This trench full of ballast should be heavy enough to resist the sliding action of the clay.

The new highway is being built on an alinement that will straighten the curves and ease the grades. The old road, for example, had a 14 percent grade on the south hill. On the new highway this will be replaced with a 4.3 percent grade. The steepest, which is on the north hill, will be 7 percent. The new bridge is 28 ft. wide, 10 ft. more than the old one, and the deck is about 20 ft. higher, which should put it out of reach of floods.

To keep Sandstone Creek from undercutting the roadway, 2000 ft. of the channel are being straightened and riprapped at an approximate cost of $100 a foot.

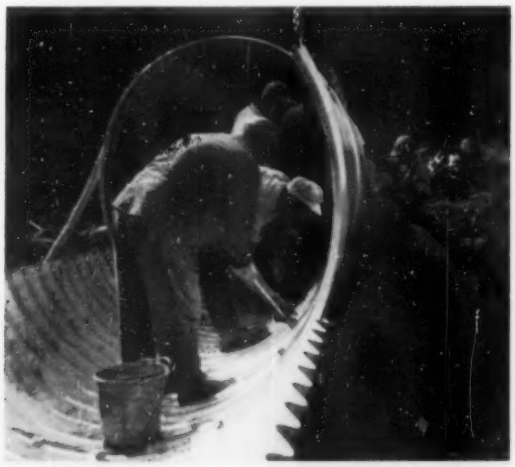
The entire project requires moving more than a million cubic yards of earth. About 40 percent of it cannot be used for embankment construction; so it will be utilized to build a scenic turnout over the Ontonagon River. Because the highway generally runs along hillsides, 15,200 feet of steel beam guardrail was specified by the plans.

Storm Drainage

The new highway will have an elaborate drainage system. Frankly, no one expects it to handle all the water that comes off the hills after a heavy rain. But a system of sewers, culverts, catchbasins, and headwalls with baffles, all especially designed, will help control erosion and will cut maintenance costs.

Culverts under the new road are extraordinarily long, up to 500 feet, because the flattening out characteristic of the clay requires embankments to be two or three times as wide at the bottom as they would be with more stable soil. More than 2000 feet of 72-in. corrugated metal pipe was used to carry small streams under the road, and corrugated pipe of lesser diameters was used in crossroad culverts and sewers.

Three contractors are working on the job—one on the bridge and two on the road. The contract price for the entire job totals about $2,700,000—a relatively high price for a rural two-lane highway. The work was 40 percent completed by January 1. Barring misfortune it will be finished on or before the scheduled November 15, 1959, completion date.



● **UNSTABLE soil complicated the drainage problem. Workmen are assembling a section of multi-plate pipe.**

Photos courtesy Armco Drainage & Metal Products, Inc.

● **BRIDGE over the Ontonagon River. This view, taken from the south, shows deep cut in unstable clay formation in background.**

PRESSURE LOSS IN AIR MAINS DUE TO FRICTION

R. S. RANKIN,
Consultant,
Water and Sewage Treatment

IN THE DESIGN of an aeration system for an activated sludge plant, the sizing of compressed air transmission piping can be a tedious and bothersome task for the average sanitary engineer. Infrequent contact with this design problem does not give him the opportunity to become as proficient in its solution as he is with other problems such as those of a hydraulic nature. Hence, it seems worthwhile to present a solution, simplified as much as possible, that can be applied by chart or formula with a minimum of effort; also to develop values for land elevations above the usual sea level base since most areas of application are not on the seashore. To do this properly, and so that the final results can be understood or verified, fundamental formulae are introduced and developed.

The fundamental Darcy-Weisbach pipe formula:

$$h_f = f\frac{L}{D}\frac{V^2}{2g}$$

is familiar to engineers as denoting the loss of head due to friction in a hydraulic system of piping. For a compressible gas system of piping and where pressure drop is relatively small it has been converted in Eshbach's Handbook of Engineering Fundamentals as follows:

$$\Delta P = f\frac{L}{2g}\times\frac{RT}{P}\times\frac{(M/A)^2}{D} \quad \ldots\ldots(1)$$

where

ΔP = pressure drop due to friction in pounds per sq. ft.;
f = friction factor;
L = length, ft.;
g = 32.16;
R = gas constant which for air is 53.34;
T = absolute temperature, degrees F.;
P = absolute pressure pounds per sq. ft.;
A = area of pipe, sq. ft.;
D = dia. of pipe, ft.; and
M = mass rate of flow, lb./second, derived from AV/u, where V = velocity, ft./sec. and u = specific volume, cu. ft./lb.

For normal calculations, these units are converted to more familiar terms as follows:

$\Delta P = \Delta p \times 144$, where Δp = pressure drop in lb./sq. in.
$P = p \times 144$, where p = pressure in lb./sq. in. absolute.
$AV = q/60$ where q = cfm.
$A = \pi/4(d/12)^2$ where d = dia. in inches.

Substituting in Eq. 1, Δp equals

$$\frac{53.34\times12^5}{64.32\times144^2\times60^2\times0.7854^2}\times\frac{fLTq^2}{pu^2d^5} = \frac{1}{223.17}\times\frac{fLTq^2}{pu^2d^5} \quad \ldots\ldots(2)$$

Some engineers may prefer to substitute for u the value 13.093, its value when T = 519.6° (60°F) and 14.7 lb./sq. in. In this case

$$\Delta p = \frac{1}{38{,}250}\times\frac{fLTq^2}{pd^5} \quad \ldots\ldots(2a)$$

Eq. 2 can be simplified further by determination of temperature T due to adiabatic compression of the air as follows:

From thermodynamics applied to adiabatic compression of a gas, $T_1/T_2 = (p_1/p_2)^{n-1/n}$
where

T_1 = initial absolute temperature;
T_2 = terminal absolute temperature of compressed gas;
p_1 = initial absolute pressure;
p_2 = terminal absolute pressure;
$n = c_v/c_p$, where c_v = specific heat of air at constant volume and c_p = specific heat of air at constant pressure.

For air n = 0.241/0.173 and n-1/n = 0.283.

Then $T_1/T_2 = (p_1/p_2)^{0.283}$.

If T_1 = 519.6° abs (60°F), T_2 = T and p_2 = p; then Δp =

$$\frac{1}{223.17}\times\frac{519.6}{p_1^{0.283}}\times\frac{1}{p^{0.717}}\times\frac{fLq^2}{u^2d^5} \quad \ldots\ldots(3)$$

When p_1 = 14.7, u = 13.093 and L = 100 ft.,

$$\Delta p_{100} = 0.635\frac{fq^2}{d^5p^{0.717}} \quad \ldots\ldots(4)$$

where

Δp_{100} = pressure drop in 100 ft. in lb./sq. in.
f = friction factor
q = volume of "free" air in cu. ft./min.
p = compressed air pressure in lb./sq. in. absolute
d = dia. of pipe in inches

The friction factor "f" is the one element in this equation where individual judgment enters. However, L. F. Moody in his excellent paper "Friction Factors for Pipe Flow" in the Trans. ASME for 1944 has derived factors which seem most acceptable for application to air flow. These factors are based on assumed roughness conditions and complete turbulence of flow. On the basis of Moody's analysis, values of friction factors have been derived for four different types of pipe interiors and these are shown in Table 1. It is believed proper selection and application of the appropriate factors will yield a safe value for the pressure drop.

The accompanying Fig. 1 shows the solution of Eq. 4 for the conditions normally encountered in air piping for activated sludge plants. Although the chart includes values for a gage pressure of zero, these are included only for reference. Obviously with zero gage pressure any loss of pressure is meaningless.

It will also be noted that temperature factors are eliminated as these have been calculated as explained above and do not need to be considered. However, for those who are interested, the calculated values are shown in Table 2.

Table 1—Friction Factors for Different Pipe Interiors (values of f)

Diameter, Inches	Steel or Wrought Iron	Asphalt Lined Cast Iron	Galvanized Iron	Plain Cast Iron
1	.023	.030	.032	.038
1¼	.0216	.0282	.0296	.035
1½	.0206	.027	.0282	.0328
2	.0191	.025	.0263	.030
2½	.018	.0235	.025	.028
3	.0175	.0225	.0238	.027
4	.0163	.021	.0222	.0252
6	.0153	.019	.0202	.0228
8	.0143	.0178	.0189	.0212
10	.0137	.0168	.0180	.0200
12	.0133	.0160	.0172	.0192
14	.0129	.0154	.0166	.0185
16	.0126	.0150	.0161	.0180
18	.0123	.0145	.0156	.0174
20	.0120	.0140	.0152	.0170
24	.0116	.0135	.0146	.0163
30	.0112	.0130	.0140	.0154
36	.0108	.0124	.0134	.0148
42	.0104	.0120	.0130	.0143
48	.0102	.0115	.0125	.0140
54	.0099	.011	.012	.0135
60	.0097	.0108	.0118	.0132
72	.0094	.0103	.0113	.0127
84	.0090	.0098	.0108	.0122

Table 3—Effect of Elevation and Density of Air at 60° F

Elevation ft. above Sea Level	Abs. Pressure lb./sq. in.*	Density lb./cu. ft.	Volume cf/lb.	Volume Ratio to Sea Level
0	14.70	.0764	13.093	1.00
1000	14.17	.0735	13.605	1.04
2000	13.66	.0709	14.113	1.08
3000	13.17	.0683	14.638	1.12
4000	12.69	.0658	15.192	1.16
5000	12.23	.0634	15.764	1.20

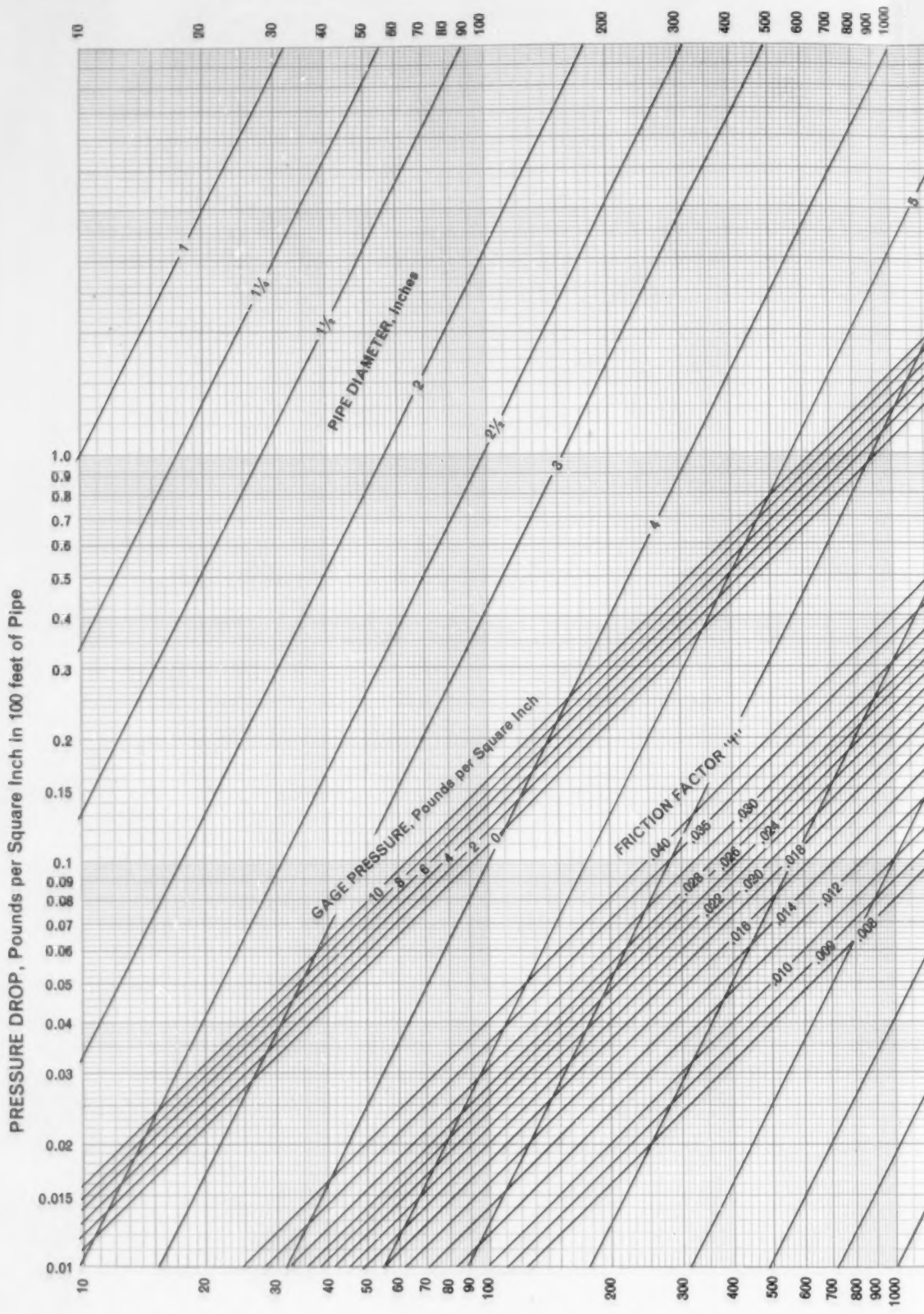
* Eshbach's *Handbook of Engineering Fundamentals.*

Table 4—Effect of Altitude on Compressed Air Line Losses Initial Temperature = 60°F*

Elevation ft. above Sea Level	Gage Pressure, lb./sq in. 0	2	4	6	8	10
0	.0925	.0845	.0779	.0724	.0678	.0638
1000	.0887	.0808	.0744	.0690	.0645	.0605
2000	.0856	.0775	.0711	.0660	.0615	.0578
3000	.0825	.0747	.0682	.0630	.0587	.0550
4000	.0795	.0715	.0655	.0601	.0560	.0524
5000	.0766	.0687	.0625	.0575	.0534	.0499

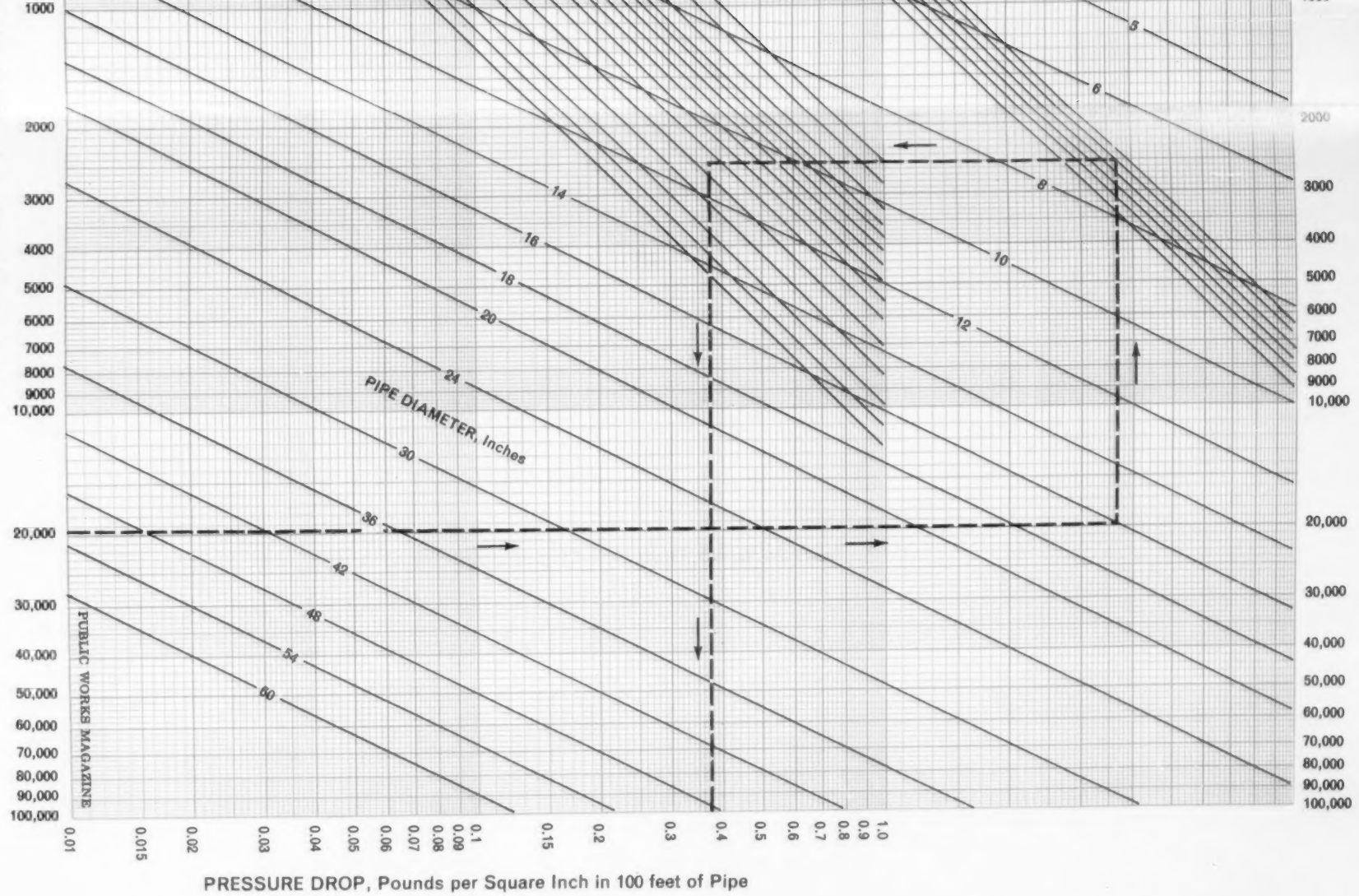
* To obtain $\Delta p_{(in.)}$ multiply above factors by $\frac{f\,q^2}{d^5}$.

FOLD OUT – DO NOT TEAR


PRESSURE DROP, Pounds per Square Inch in 100 feet of Pipe
PIPE DIAMETER, Inches
GAGE PRESSURE, Pounds per Square Inch
FRICTION FACTOR "f"
CUBIC FEET per MINUTE of "FREE" AIR at 60°

EXAMPLE: Given q=20,000 CFM
d=16", p=8 lb./sq. in., f=0.015

FIGURE



t 60°F., 14.7 Pounds per Square Inch Absolute

URE 1

ANSWER: 0.38 lb./sq. in.
Pressure Drop in 100 ft. of Pipe

Table 2—Air Pressures and Temperatures

Pressure, lb./sq. in. Gage	Abs.	Compressed Air Temperature °Abs.	°F
0	14.7	519.6	60
2	16.7	538.7	79.1
4	18.7	556.0	96.4
6	20.7	572.7	113.1
8	22.7	587.1	127.5
10	24.7	601.8	142.2

In the foregoing discussion it has been assumed that the temperature of the "free" air undergoing compression is at 60°F. Such conditions do not always prevail and some engineers may have occasion to consider other temperatures. For this purpose, calculations have been made for other temperatures and factors have been determined to apply to the pressure drop as computed for 60°F. These factors based on variations in T, (absolute temperature) and corresponding volume per cu. ft. (u) while not of great significance are as follows:

t°F of "free" air	Multiplier for Δp_{100} at 60°F
40	0.96
50	0.98
60	1.00
70	1.02
80	1.04
90	1.06
100	1.08

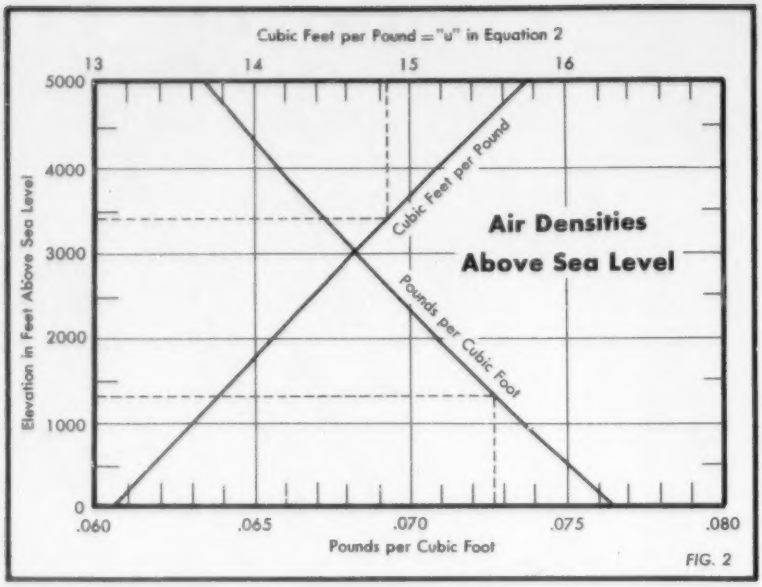


FIG. 2

Another variation which has a greater effect than temperature is the altitude of the installation. So far, all data has assumed a sea level elevation but many areas are considerably above sea level. Altitude affects the volume of air per cu. ft. so that if a weight of air equivalent to that at sea level is desired, an allowance must be made for the decrease in density by compressing more air volume. These values are shown in Table 3 and Fig. 2.

To illustrate the effect of altitude the factors in Eq. 3 have been calculated for various elevations from sea level to 5,000 ft. using an intake temperature of 60°F. These values are shown in Table 4 and Fig. 3.

The tabular values in Table 4 may imply unwarranted precision in the final values sought. However, precision in known or accepted factors seems justified so that the final answer will deviate solely with any assumed factors which in this case is the friction factor f.

Typical examples follow:

1) Assume sea level elevations with q = 20,000 cfm; p = 8 lb. gage = 22.8 lbs./sq. in. absolute; d = 16″, f = .015 (for 16″ asphalted C.I. pipe).

From Table 4:

$\Delta p_{100} = .0678 \times 20{,}000^2/16^5 \times .015$
$= 0.388$ lb./sq. in.

or from Equation 4:

$\Delta p_{100} = .635 \times .015 \times 20{,}000^2/9.381 \times 16^5$
$= 0.388$ lb./sq. in.

Fig. 1 also gives this same answer.

2) Assume elevation of 5,000 ft.; q = 20,000 cfm; p = 8 lb. gage pressure; d = 16″; f = .015.

From Table 4:

$\Delta p_{100} = .0534 \times .015 \times 20{,}000^2/16^5$
$= 0.306$ lb./sq. inch.

3) If q is to provide the same weight of air as at sea level then from Table 3, q must be $1.20 \times 20{,}000$ or 24,000 cfm. Applying this to example 3:

$\Delta p_{100} = .0534 \times .015 \times 24{,}000^2/16^5$
$= 0.44$ lb./sq. in.

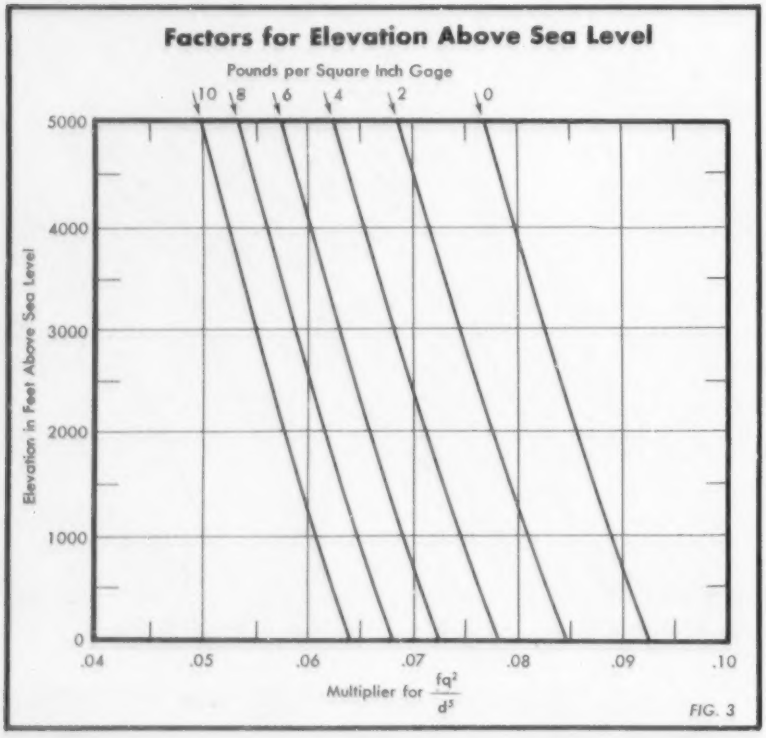


FIG. 3

The Effect of Adding Water to Municipal Refuse for Increased Compaction in Sanitary Landfills

EDWARD R. WILLIAMS,
GEORGE F. MALLISON
and
PAUL P. MAIER

This is a contribution from the Communicable Disease Center, Bureau of State Service, Public Health Service, U. S. Department of Health, Education and Welfare, Phoenix, Arizona.

ATTEMPTS have been made by sanitary landfill operators to increase the compaction of municipal refuse by sprinkling the wastes with water as they are layered and compacted during landfill operations. In an experiment carried out by the San Diego, California, Department of Public Works (1), a sample of municipal rubbish was saturated with water and compacted to a density of about 1200 pounds per cubic yard in a sanitary landfill. Another sample of rubbish was compacted without added water to a density of about 600 pounds per cubic yard. Although a 100 percent increase in the density of the compacted rubbish was obtained by adding water in this experiment, the value of the increased site capacity obtained by better compaction of the water-saturated refuse was considerably less than the costs of the water application.

A small-scale study was made in connection with other municipal refuse investigations at Chandler, Arizona, (2,3) in an attempt to determine the practical value of adding water to increase compaction. In this study, ten samples of combined residential and commercial refuse was tested. In two the refuse was compacted as delivered, while various percentages of water were added to the remaining eight samples prior to compaction. The amount of water added was based on the weight of the refuse as received at the landfill. Water, when used, was sprayed onto the refuse not more than 15 minutes before it was compacted. Compaction was accomplished with a crawler-type tractor in the 30-40-drawbar horsepower class with a bulldozer attachment. This tractor provided an average compaction pressure of about 5 psi. The contours of the landfill area filled in each test were measured with an engineer's level before refuse was added and after it was compacted. The densities of the compacted refuse were computed from the original weight of the material divided by the volume occupied after compaction. The results of the tests are summarized in Table 1.

Table 1—Results of Tests in Chandler, Arizona

Water Added, %	*Avg. Total Weight per Sample*, lbs.*	*Avg. Density after Compaction** lbs. per c. y.*
0	21,500	642
5	14,500	668
10	14,200	716
15	12,900	653
20	17,800	729

* Two samples were tested at each percent of added water.
** Based on original weight of refuse, without added water.

The data in Table 1 indicate that there was no significant difference in the degree of compaction in a sanitary landfill of refuse as delivered or of refuse with water added in amounts ranging from 5 to 20 percent of the weight of the refuse. Also, it was found that the refuse became more difficult to spread with a bulldozer blade after water was added and, in addition, the entire sanitary landfill area became decidedly more attractive to adult flies when water was used.

It was concluded that the addition of quantities of water up to 20 percent by weight of the refuse to increase compaction in a sanitary landfill is of no practical value. However, it must be emphasized that the tests described here were carried out in an arid, relatively hot climate and may not be completely comparable to results of similar tests in other areas.

References

1. "Planned Refuse Disposal"—A Report to the Directors of the County Sanitation Districts of Los Angeles County, California. Joint Administrative Staff, County Sanitation Districts of Los Angeles County, California. A. M. Rawn, Chief Engineer and General Manager. pp. 48-49, September 1955.
2. "The Use of Light Equipment for Small-town Sanitary Landfill Operations." Edward R. Williams, Paul P. Maier, and George F. Mallison. *Public Works* 89:89-91, 1958.
3. "The Composition and Quantity of Refuse in Chandler, Arizona." Edward R. Williams George F. Mallison, and Paul P. Maier. (In Manuscript.)

GRADERS BUILD UP A WIDER ROAD

● **AS PART of an extensive road widening and paving program, these Huber-Warco graders owned by Custer County, Oklahoma, are spreading gravel to build up a newly widened section of road leading to a reservoir under construction near Arapaho.**

A FIELD STUDY of Contact Aeration

ERNEST W. STEEL,
Professor of Civil Engineering,
The University of Texas,
Austin, Texas

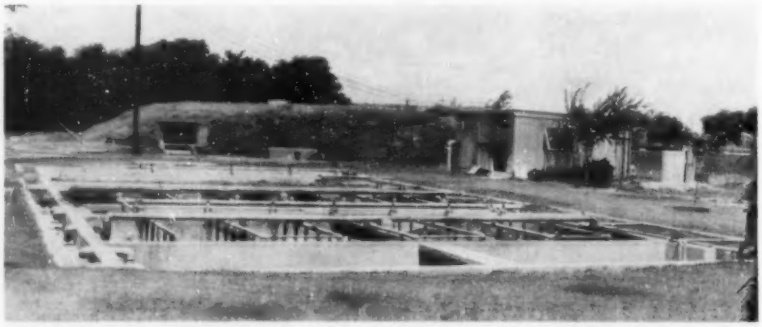
THE CONTACT aeration method of treating sewage is now in use at 231 plants in the United States and Canada. The method is approved by the health departments of 22 states.

Contact aeration, as presently used, was developed by Clyde C. Hays over 20 years ago at Waco, Texas, and the first installations were made in that state. It is sometimes called the Hays Process, although other engineers have contributed to its development into the present type of plant. Consequently in some areas it is known as the Griffith Process.

Various experiments with contact aeration had been made by investigators prior to Hays' work, with indifferent results. It was Hays' idea that if aeration were provided in successive well-defined stages, different types of flora and fauna would develop at different stages throughout the process, and they would be more efficient than the mingled population found in a mass of activated sludge. Whether this is important is debatable. The experimentation, however, established the optimum relationships between the biochemical oxygen demand and the required contact surface, the most serviceable type of contact surface, the amount of air and the aeration period.

The first installation was at Elgin, Texas, design population 2800, made in 1938. Contact surfaces were 3-in. crushed stone. This plant was enlarged in 1952 to 3600 population by substituting ¼ in. x 4 ft. x 7 ft. asbestos-cement sheets for the crushed stone. This plant continues to give satisfactory service. Other Texas cities also adopted the use of this process, including Big Spring, design population 20,000, in 1942. The Big Spring plant was enlarged in 1954 to a design population of 30,000, continuing the use of submerged contact aeration. The effluent of this plant is sold to a local oil refinery where it is used in cooling towers and for boiler feed water.

During World War II a number of installations were made at army camps and cantonments. When well operated and not overloaded, they were satisfactory. It should be recognized that contact aeration exhibits somewhat the same characteristics as activated sludge when overloaded, insofar as quality of effluent is concerned. There is, of course, no difficulty with an objectionable bulking sludge. Solids sloughed from the contact surfaces invariably settle satisfactorily.



● **SUBMERGED contact aeration plant at McGregor was designed for flow of 0.385 mgd. Flow rate, 8 am to 4 pm, is 0.171 mgd. Overall BOD removal averaged 93%.**

Plant Design

The present contact aeration plant design includes a bar screen, primary sedimentation tank with a 2-hour detention period; a first-stage aeration tank with 1.2-hour detention period; an intermediate sedimentation tank with a 1-hour detention period; a secondary aeration tank with a 1.2-hour detention period; and a final sedimentation tank with a 1-hour detention period. It will be seen that the total detention period for the sewage is 4 hours for sedimentation and 2.4 hours for aeration, although this, in some instances, has been increased to more than 3 hours. It will be noted that, even with a 3-hour aeration period, the total detention period is 7 hours, whereas, at an activated sludge plant, which provides the usual 6-hour aeration period, the total detention period is usually 9 hours.

Contact surfaces are provided by ¼-inch asbestos-cement plates, placed vertically in panels on 1½-inch centers. The plates are usually 4 ft. by 8 ft. in as many rows as required. Air is applied through porous tubes of 40 permeability and 4¼-inch outside diameter, placed on 2-ft. centers. The incoming sewage is directed downward by a baffle and rises 8 feet between the plates. Some of the heavier particles of the contact film, which are dislodged from the surfaces, fall into trough-like hoppers beneath the contact plates and are withdrawn at intervals throughout the day by means of a horizontal air lift. They are returned to the primary sedimentation tank. Other sloughed solids are removed by the intermediate and final sedimentation tanks. The solids resemble those which are removed in final tanks of trickling filter plants. These solids are also returned to the primary tank and the mixed sludge from it is digested in a separate digestion tank. At some plants supernatant liquor from the digestion tank is aerated with some of the intermediate or final sludge and discharged to the primary sedimentation tank. The sludge well is provided to concentrate sludge before it is sent to the digester. A chlorine contact chamber providing 15 minutes detention may also be provided.

Contact aeration surface is provided in the amount of 1000 square feet for each 6.4 pounds of daily BOD load which is applied. This loading is based upon the BOD exerted by the sewage at or near peak strength or usually, 150 percent of the average. The area furnished is equally divided between the two aeration stages. At some of the earlier plants the loadings were placed somewhat higher, 8.1 pounds of BOD per 1000 square feet.

The air required is 1.5 cubic feet

per gallon of sewage. Air compressor capacity is provided, however, to increase this by 50 percent during the hours of peak flow. Since the aeration tanks are comparatively shallow the blowers operate at 5 pounds per square inch. The air amounts given also provide for sludge pumping and aeration of supernatant liquor.

The short overall detention period of the sewage and the use of rectangular tanks with common walls has made the first cost of contact aeration plants compare favorably with that of other methods of sewage treatment. The compact arrangement, combined with low first cost, has resulted in many small installations in suburban areas where, with what might be called ordinary operation, they have given satisfactory, nuisance-free service. By ordinary operation is meant the use of untrained operators who receive only occasional checking by engineers of health departments.

Specific Plant Studies

The plants chosen for study serve four types of population, an Air Force Base, a suburban community, a small town and a medium-sized city. They were also chosen on the bases of adequate operation, accuracy of flow measurement and ease of access. All receive only normal domestic sewage. It was hoped that at least one, the Ridgecrest plant, would be overloaded, but unfortunately this was not the case. Details of the plants are as follows:

McGregor. This small town had a 1950 population of 2,700; design population, 5,500; design flow, 385,000 gallons per day. Actual flow rate 8 a.m. to 4 p.m., 171,000 gallons per day. Operation is by one part-time man. Plant was completed in 1955.

Baytown. This city has a population of 25,000 not all served by this plant. Design population was 10,000; design flow, 700,000 gallons per day; actual flow throughout day, 431,000 gallons. Operation is full time. Plant was completed in 1958.

Ridgecrest. This is a suburban community in the Houston area. The sewer system is operated as a privately owned public utility. Design population was 5500; connected population, 5173, in addition to 88 commercial establishments serving the surrounding area; design flow, 385,000 gallons; actual flow throughout day, 361,000 gallons. This plant includes a preaeration tank with a 1-hour detention period, followed by the primary sedimentation tank also with a 1-hour detention period. Operation is full time with day and night operators. Plant was completed in 1954.

Connally Air Force Base. Design flow was 851,500; actual flow throughout day, 451,000. Operation is full time, day and night. Plant was completed in 1954.

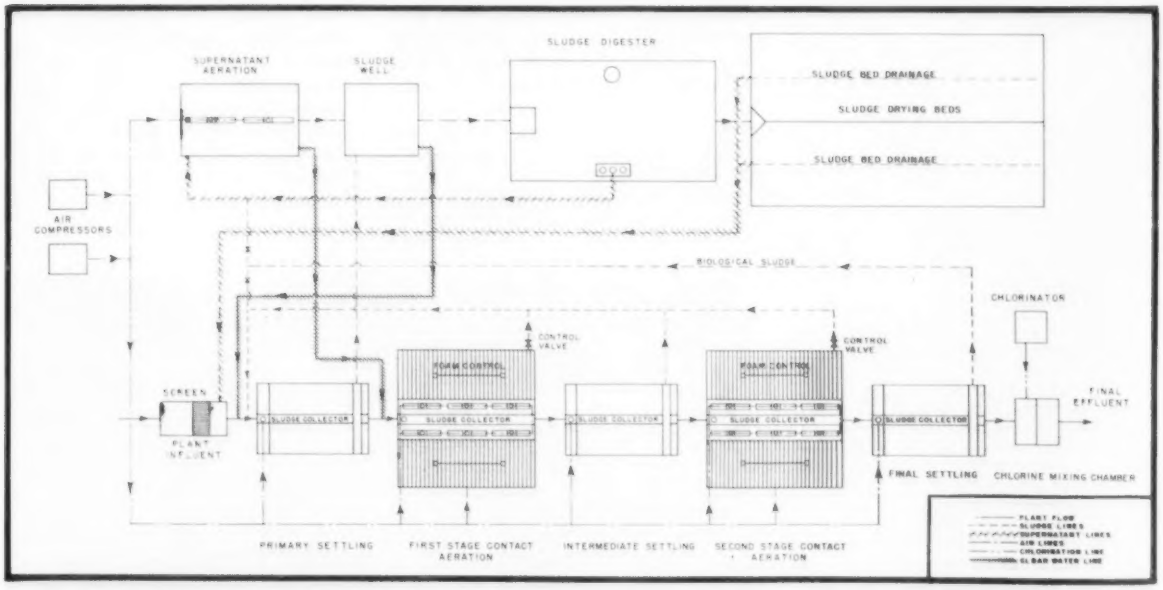
Since the surface area requirement of 1000 square feet per 6.4 pounds of BOD per day is based upon peak demand, the samples were collected and composited at three of the plants during the working day only. These results are indicated in Tables 1 and 2 and the pounds of BOD applied per 1000 square feet are, therefore, daily rates over this period. The exception is Connally Air Foree Base, at which the samples were collected over the whole 24 hours. The figures for this plant were adjusted so that the BOD loading per 1000 square feet would be on the same basis as the other plants. Other figures for this plant were not changed. Three sets of samples were obtained at each plant and the results were averaged.

The Baytown samples were also tested for nitrification. Ammonia nitrogen was reduced from 29 mg/L,

Table 1—Suspended Solids Loading and Performance

Plant	Influent	Presettling Effl.	Presettling Removal	1st Stage Aeration* Effl.	1st Stage Aeration* Removal	2nd Stage Aeration* Effl.	2nd Stage Aeration* Removal	Overall Removal
	mg/L	mg/L	%	mg/L	%	mg/L	%	%
Ridgecrest	308	182	61	94	48	57	39	81
McGregor	266	75	72	50	33	36	28	86
Baytown	264	81	69	28	65	17	39	94
Connally A. F. Base	143	53	63	24	55	20	17	86

*Includes settling



● **FLOW DIAGRAM of a contact aeration plant showing primary, intermediate and final settling and two stages of aeration.**

Table 2—BOD Loading and Performance

Plant	Influent mg/L	Presettling Effluent mg/L	Presettling Removal %	1st Stage Aeration[1] Effluent mg/L	1st Stage Aeration[1] Removal %	2nd Stage Aeration[1] Effluent mg/L	2nd Stage Aeration[1] Removal %	BOD Loading[2] lb.	BOD Removal[2] lb.	Overall Removal %
Ridgecrest	197	112	43	52	54	15	72	4.51	3.49	92
McGregor	136	75	45	36	52	10	72	1.43	1.24	93
Baytown	191	103	46	17	83	8	53	1.67	1.43	96
Connally A. F. Base	151	99	34	20	80	12	40	3.96	3.28	92

[1]Includes settling
[2]lbs. per 1,000 sq. ft. of plate area per day

to 14 mg/L, or 52 percent, but nitrates were never above 0.6 mg/L, and averaged 0.4 mg/L, while nitrites also averaged 0.4 mg/L.

Most of the analyses were made in the Sanitary Engineering Laboratory of the University of Texas. Illness of the analyst, however, necessitated making of some of the tests in the laboratory of the Texas State Department of Health.

Tables 1 and 2 show results in removal of suspended solids and satisfaction of BOD respectively. The results are remarkably good. To this the objection may be made that the plants, with the exception of Ridgecrest, are operating much below the design capacity. Another viewpoint, however, is that the design criteria used are very conservative and, if complied with, will insure a good effluent with a considerable factor of safety. Two of the plants are located in built-up areas with no nuisance complaints.

Reports of the contact aeration process are few in number. Several will be found in the bibliography below. It appears that the process has won a place in sewage treatment and merits further study both by engineers who are primarily interested in operating results and by practicing engineers who are concerned not only with performance but also with the economics of sewage treatment.

Bibliography

1. Ellis, G. H., "Found: A Sewage Works the Village Can Afford", *Engineering News-Record*, 146 (May 10, 1951).
2. Wilford, J. and Conlon, T. P., "Contact Aeration Sewage Treatment Plants in New Jersey", *Sewage and Industrial Wastes*, 29, 845 (August. 1957).

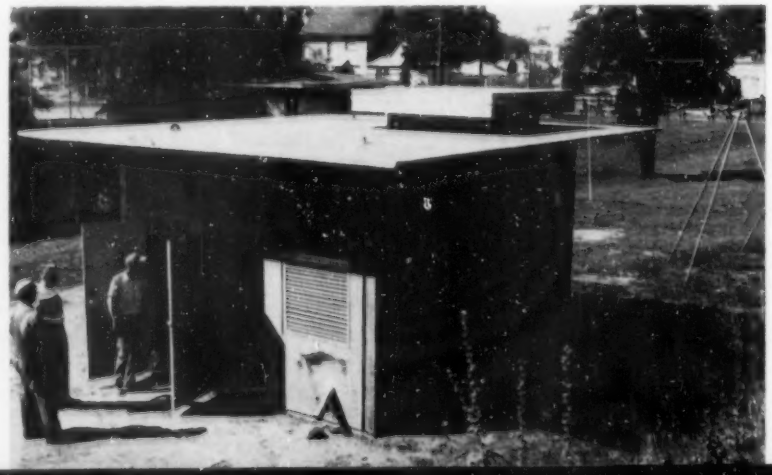
City Prefabricates Housing for New Well

ANDREW J. BROWNING
City Manager,
Pendleton, Oregon

SUFFICIENT water supply to meet present needs and to provide for future expansion requirements is assured the City of Pendleton, Oregon, as a result of the completion of a new 2,400 gpm well and pumping installation in a city park. The well was tested and found satisfactory in early July, 1959, and is now ready to be connected into the city's distribution system. This $85,000 addition will supplement the existing supply system to provide a maximum of 16 million gallons per day. Pendleton's present population is 15,300.

The consulting engineering firm of Cornell, Howland, Hayes and Merryfield of Corvallis, Oregon, worked closely with Water Superintendent Ray Struthers in the planning and design of the installation. Midland Drilling Co. was the contractor for drilling the 700-foot well, which ranges in diameter from 20 to 30 inches. This portion of the work was completed in August, 1958. Layne and Bowler, of Los Angeles, Calif., supplied and installed the 2,400 gpm pump and the control center. Remote controls for all five city wells are located at the water department's shop.

City construction forces undertook the housing of the pumping station with a new type of shelter, which lends itself to being easily dismantled and reassembled for future maintenance projects. Concrete flooring was poured in place at the well site. The four walls and the roof were poured in the municipal garage as separate reinforced concrete slabs. These sections were then taken to the pumping site, hoisted into place with two lift cranes, and bolted together. City forces also installed all pipe and fittings, set the electrical control equipment, and accomplished all wiring. The well will be connected to a 10-in. distribution main to tie into the present distribution system.



● **SHELTER for Pendleton's new water well uses prefabricated walls and roof. Note lifting eyes for removal of the roof.**

CLEANING GUARD RAILS

R. A. SCOTT,

**District Maintenance Superintendent,
Texas Highway Department,
Austin, Texas**

FROM THE time the Gulf Freeway in Houston was opened to traffic until the Spring of 1956, nine persons were killed and 70 injured in 60 accidents caused by vehicles crossing over the 4-ft. median and colliding with oncoming traffic. It was realized that it was necessary for some measure to be taken to reduce the traffic fatalities on this section of road. It was decided to erect a flex-beam barrier fence in the median.

Work on the barrier fence was begun by State maintenance forces in May of 1956 and completel by October, 1956, at a cost of $188,000 for approximately 5.7 miles. Upon completion, the railing was painted with AP-1 "Aluminum" paint which has good reflective qualities when clean; however, the railing soon becomes covered with road film which impairs its visibility. It was realized that it would be necessary to clean the flex-beam frequently to keep it visible for night-time traffic.

Our first attempt to clean the rail was by hand washing. This operation took twelve men three days with detergents, brushes and water to clean one mile of railing. It was immediately evident that the hand method was not practical from the economic standpoint; and, in addition, having twelve men exposed to the hazards of the high-volume, high-speed traffic was of greater concern. It was, therefore, necessary that we devise a safer and more economical method for this cleaning operation.

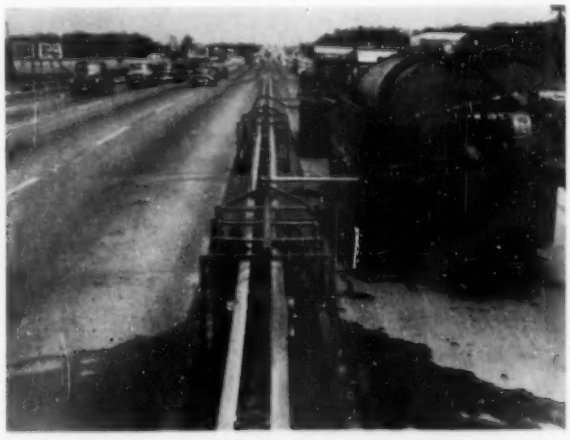
In the early spring of 1957 we received one of the sign washing machines made in Camp Hubbard. We used this machine to clean the railing in the same manner that we used it for washing signs—by applying the detergent with a pump and hand spray and rinsing with a hose attached to a pump mounted on a water tank. This was some improvement over the hand and brush method but it still was not the answer as it was slow and we could wash only one side of the railing at a time and were unable to keep from spraying some of the detergent on the passing cars. Even though the detergent that we were using was not harmful to cars, it aroused the ire of the motorists.

As neither of the above methods of cleaning the rail was satisfactory, we concluded that, from necessity, we must devise some mechanical method for cleaning the railing. After numerous attempts, we devised and made in our District shops the machine we are now using. With this machine we can clean the approximately 5.7 miles of railing on both sides in six hours. We use 50 gallons of detergent, "Hi-Sign Cleaner", mixed with ten parts of water for the 5.7 miles of railing, and 1200 gallons of water for rinsing. The detergent is applied to both sides of the railing at the same time using sixteen ¼-inch jet nozzles, TT 6504. The detergent application is followed by the rinsing equipment which is equipped with 24 nozzles of the same size and type as used in applying the detergent — eight nozzles in front of the brushes and sixteen for the final rinsing. In making this equipment it was necessary that we have the brushes especially made by a brush manufacturing firm to fit the flex-beam. We purchased the nozzles and casters from local distributors, and all of the other materials were from our warehouse stock. The entire operation requires five men, two dump trucks —one for the detergent and pump and one for the water and pump for rinsing—and one pickup truck to pull a large "SLOW" sign. The approximate cost for washing the 5.7 miles of flex-beam railing is $114, or $20 a mile.

The specifications for the washing machine are available in the Equipment and Procurement Office of the Highway Department in Austin.

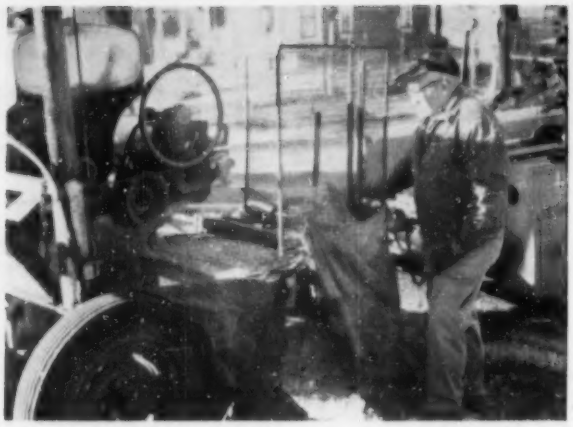
This paper was presented at the Thirty-Third Annual Short Course in Highway Engineering, Texas A & M College.

● **SPRAY machine uses detergent to wash guard rail. Devised and made in the Highway Shops, this saves much labor.**



● **THIS shows the detergent being applied through 16 jet nozzles. The detergent application is followed by rinsing.**

● **CLOSEUP shows how the Vermeer stump cutter rips an elm stump to shreds. Second pass removes stump below the surface.**



● **OPERATOR of Rockford's stump cutting machine, Vernon Bochanan, completes removal of stump in 45 minutes.**

STUMP REMOVAL on a LARGE SCALE

LARGE-SCALE stump removal programs are among the problems facing many cities, especially in those areas where inroads of the Dutch elm disease have destroyed hundreds of trees along residential streets. Since control of this lethal tree disease is recognized to be a two-fold approach, spraying plus prompt removal of diseased trees, it is inevitable that in affected areas, streets that were formerly lined with beautiful shade trees may now have only unsightly stumps.

Within the past five years the City of Rockford, Illinois, has been seriously invaded by Dutch elm disease, and the necessary tree removal program has left a great number of elm stumps throughout the city. To remove this wreckage, the City purchased a Vermeer stump cutter late in 1957. Experience with this machine has been very satisfactory.

The stump cutter operates a heavy-duty cutting wheel which is hydraulically controlled to provide side-to-side movement plus vertical and horizontal motion. Power is supplied by a gasoline engine. Mesh shields protect the operator from flying chips and retractable canvas shields prevent scattering of chips. The entire unit is mounted on wheels for quick transportation from job to job.

In Rockford, stump removal operations can be carried out whenever the ground is not frozen hard. During 1958, a total of 1,451 stumps were removed. These averaged 18 inches in diameter and all were cut at least 8 inches below the surface of the ground, with some being cut much deeper. It takes about 45 minutes to remove the average stump, including setup time.

In addition to the stump cutter, the removal team consisted of a truck and a front end loader with an operator for each. After the stump has been completely cut up, the chips are removed, leaving a clean hole. This is filled with good soil, leveled, and sowed with grass seed. Within a few weeks it is hard to tell that a tree was ever there.

Costs of this operation are far lower than by other means. Based on Rockford's experience during 1958, it was found that it cost $8.19 to remove each stump. This included all fuel and oil and the replacement of cutting teeth when necessary. Also included was the cost of operating the truck and front end loader, with their related labor charges.

All of the stumps removed by this method in Rockford have been located between sidewalks and curbs. The work was carried on in practically all parts of the city. Because of the terrific backlog of stumps that remain and the unrelenting toll of Dutch elm disease, it is anticipated that the same rate of stump removal, about 1500 per year, will continue for some years in the future.

Stump cutting operations in Rockford are conducted by the Forestry Department, a division of the Street Department; William Grosch, a graduate forester, is foreman in charge of this work. Much of the information in this article was furnished by Lee E. Drake, Superintendent of Streets. Lane H. Mashaw is City Engineer.

Photo courtesy League of Wisconsin Municipalities

● **AFTERMATH of the Dutch elm disease left only stumps along this street in a midwestern city. Rockford's problem is shared by many other communities in the area.**

NEW INCINERATOR GIVES COMPLETE Fly-Ash Control

JOHN L. HAYDEN
President,
Hayden, Harding & Buchanan, Inc.,
Consulting Engineers,
Boston, Massachusetts

A MUNICIPAL incinerator, unique in many respects, has just been placed in operation in Belmont, Mass. In fact, it has been called the most modern in the nation. The $630,000 plant with a nominal rating of 150 tons of refuse per day permits reclamation of a dump, long a public nuisance, which will now be converted into a beautiful municipal park.

The 16-acre site for the incinerator was obtained from the Commonwealth of Massachusetts for the bargain price of $1.00, an outstanding example of Town-State cooperation. The installation was designed and construction supervised by Hayden, Harding & Buchanan, Inc., Consulting Engineers of Boston. Martin W. Manzelli Corp., of Belmont was the General Contractor.

The design incorporates cylindrical furnaces manufactured by the Morse-Boulger Destructor Company; cylindrical gas cooling chambers; multicyclone fly ash collectors manufactured by Hagan Chemicals and Controls, Inc.; induced draft fans by Clarage Fan Co.; and a complex system of instrumentation.

The colonial brick architecture of the incinerator building is in harmony with the New England tradition of the Town of Belmont, and enhances, rather than detracts from, the attractiveness of the neighboring residential area. Architectural consultant services were rendered by William Hoskins Brown Associates of Boston.

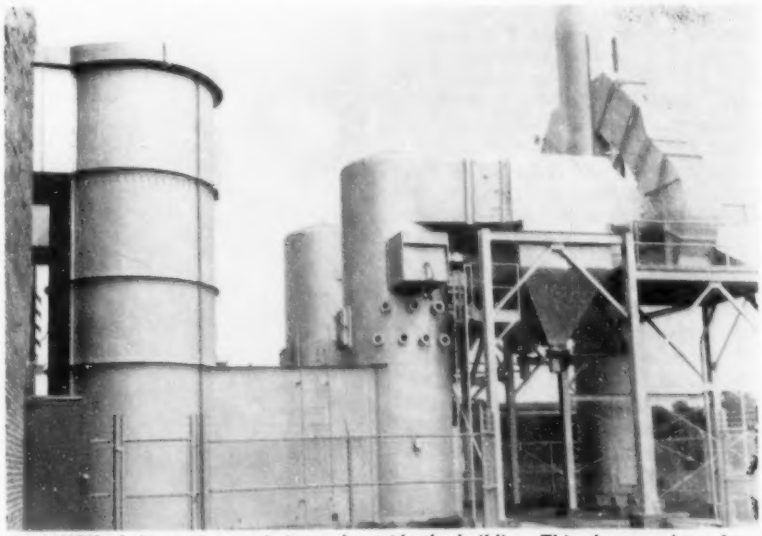
Refuse is discharged directly from the collection trucks to a storage bin sized to permit accumulation equivalent to several days average operation. This feature promotes smooth handling of peak holiday loads and efficient utilization of personnel.

Refuse is loaded into charging hoppers above the furnaces by means of an overhead bridge type crane with grab bucket. The hoppers discharge into the primary furnace chamber where the refuse is burned to incombustible residue, which is water quenched and dropped into a storage hopper below for subsequent discharge to trucks at the lowest level. Gaseous products of combustion, fly ash, unburned volatiles and water vapor pass into the secondary chamber where combustion is completed.

Up to this point the design is not unusual. Beyond the secondary chamber, however, the Engineers incorporated several unique, but highly effective features.

The gases leave the secondary chamber at approximately 1800°F

● **SIDE VIEW of the incinerator shows its overall acceptable appearance for the residential area in which it is located. Mechanical equipment is out of sight behind the building, and only the top of the short stack is visible from the street.**



● **MUCH of the equipment is located outside the building. This close-up shows from left to right: Secondary combustion chamber; gas cooling chamber; fly ash collector; induced draft fan; and stack. Access doors permit easy inspection and maintenance.**

● **CHARGING FLOOR has excellent natural lighting. Arrangement of ventilation system prevents dust from the refuse pit from being drawn over the working area.**

and pass into the gas cooling chamber where they are cooled to 650°F by finely atomized thermostatically modulated water sprays. The cooled gases are drawn upward through the spray chamber at a velocity which precludes the possibility of droplet carryover and enter a centrifugal type collector which removes 90 percent of all entrained dust and ash larger than 0.0002 inch in diameter. The cleaned gases are discharged by large induced draft fans through a stub steel stack extending only 20 feet above the roof of the building.

A barometric pressure sensitive damper in the furnace flue admits air at all operating conditions less than full load, thereby maintaining peak collector efficiency and minimizing cooling water consumption.

All fly ash removed by the collector is prevented from being discharged into the atmosphere. In this respect, the installation is a major contribution to the prevention of air pollution. This effort is consistent with what is hoped will become a national trend and eventually an accepted standard.

This new plant also has the following important design features:

1) All equipment beyond the ignition chamber is located outside the building proper, resulting in very substantial economies in building costs.

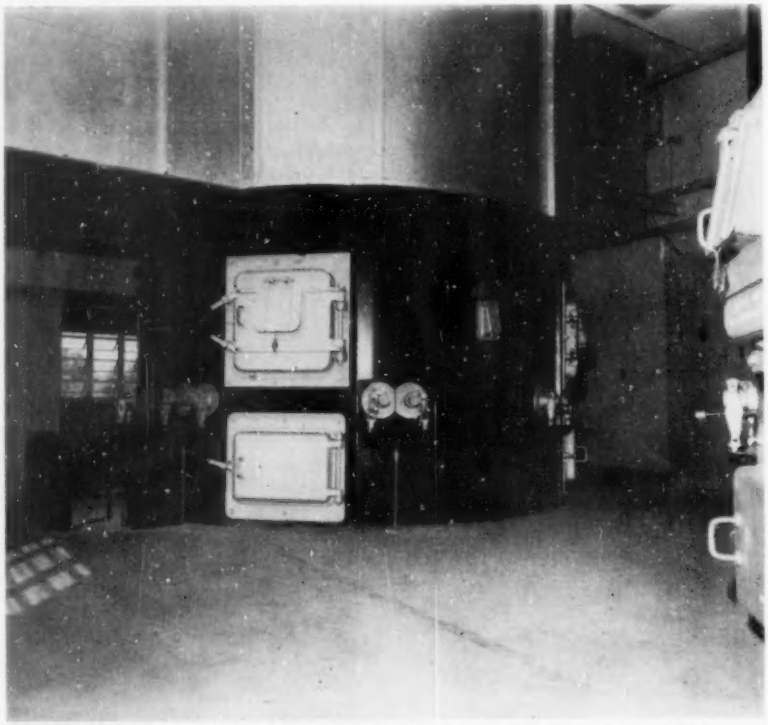
2) All air used in the furnaces is introduced from outside the building proper. This brings about a greatly reduced winter heating load, a factor which causes disagreeably cold working conditions in many incinerator plants.

3) A well illuminated and ventilated charging and stoking area employs glass and translucent plastic walls with blast cooling fans to allow optimum working environment and minimum maintenance costs.

4) A system of sprays which apply either a water or deodorizing solution to the refuse pit.

In the Belmont incinerator the Consulting Engineers have successfully accelerated the trend away from the "standard" design. Not the least important of the breakthroughs from usual practice is in the spray control system. In this plant, the spray control system follows the load with no appreciable deviation from the set point and is "fail-safe" throughout. Even complete loss of water pressure is anticipated by the inclusion of a large automatic emergency vent opening in the secondary chamber which shuts down the plant and vents the hot gases to the atmosphere upon an interruption of plant water supply pressure.

An aggressive incinerator committee, led by Walter T. Anderson, Chairman, broke a ten-year deadlock on the project. Joseph W. Kales, Town Engineer, was an ex-officio member. George B. Olsen, Superintendent of Streets, also a member of the Committee, is in charge of the incinerator.



● **ONE OF THE cylindrical ignition chambers of the Belmont, Mass., incinerator. Overpass flue is at top left; overfire air duct at top right. Stoker drive is at lower left. The center pair of castings form manual arrangement for grate dumping.**

NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Jean Vincenz Elected President of APWA for 1959-1960

Seattle, Wash.—Jean Vincenz, Director of Public Works, County of San Diego, California, has been elected President of the APWA for the 1959-1960 term. The results of the Association's election were announced at the Annual business meeting during the 1959 Public Works Congress and Equipment Show which was held in Seattle, Washington, September 20-23.

Mr. Vincenz

Mr. Crane

Mr. Screvane

Mr. Wyler

Mr. Booth

Mr. Vincenz served as Vice-President of the APWA during 1958-59. He has been a member of the Association's Board of Directors for six years and has served as a State Chairman and as a member of various standing Association Committees. Prior to his appointment as County Director of Public Works in 1947, he served as Commissioner of Public Works, City Engineer and Manager of Utilities for the City of Fresno, Calif., and from 1941 to 1947 he was Chief of Maintenance and Utilities Branch, Repairs and Utilities Division, Office of the Chief of Engineers, Washington, D. C. He is a graduate Civil Engineer of Stanford University and holds a master's degree in public administration from San Diego State College. He is a registered Professional Engineer in California, certified as a Sanitary Engineer by the American Sanitary Engineering Intersociety Board, and is a past president of the California League of Municipalities, as well as past president of the San Diego Section of both the American Society for Public Administration, and the American Society of Civil Engineers.

Crane Elected Vice President

Frederick W. Crane, General Manager of the Buffalo Sewer Authority, Buffalo, N. Y., was elected Vice President of the APWA. Mr. Crane has been a member of the APWA Board since 1953. Prior to his appointment as Manager of the Sewer Authority, he served as the Commissioner of Public Works of Buffalo, and before that he was Buffalo's City Engineer. He started work with the City in 1923, four years after his graduation from Cornell University with a CE degree. In his capacity as Commissioner of Public Works he was responsible for the Divisions of Engineering, Building and Water, and the Bureau of Smoke Abatement.

Three Directors Elected

Paul R. Screvane, Commissioner of New York City's Department of Sanitation, was elected Director of Region 2 which includes New York, New Jersey and Pennsylvania. Commissioner Screvane is past president of the New York-New Jersey Chapter of the APWA, whose annual award of merit for leadership in the field of municipal sanitation he received in 1956. He presently is chairman of the APWA Street Sanitation Committee which recently completed preparation of a textbook on street cleaning practices. Commissioner Screvane attended Mississippi State College and entered the service of the City of New York as a driver in the Department of Sanitation in 1936. As a result of competitive examinations,

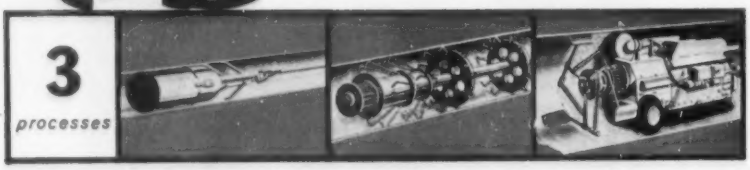
OFFICERS: Jean L. Vincenz, San Diego, Calif., *President;* Frederick W. Crane, Buffalo, N. Y., *Vice President.* REGIONAL DIRECTORS: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Texas; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore.; (term ending 1962) Paul R. Screvane, New York, N. Y.; Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D. *Immediate Past President,* Wm. D. Hurst, Winnipeg, Manitoba. Robert D. Bugher, *Exec. Director.*

WHETHER BIG,

OR VERY SMALL...

PIPE LININGS MEN CAN FIX THEM ALL

Yes, Sir! Rehabilitation of old, corroded and leaky pipe lines has been our business for many years. We repair pipe interiors with cement mortar lining... all the way up from four inches to as big as 144 inches. And mostly, this rehabilitation is done "in place," underground.



THE TATE PROCESS is for pipe diameters from 4" to 16" and is done, "in place," after by-pass lines are set up to carry on with water service.

First, the pipe is scraped and cleaned. Then, cement mortar is fed in and applied under pressure to a compact thickness of 3/16" to 1/4" giving the final effect of one continuous, cement mortar lined tube.

THE SPUNLINE PROCESS is partly TATE and partly centrifugal, developed to provide a thin lining for preventing corrosion and to restore hydraulic flow, particularly in cast iron pipe. The cement mortar lining can go past fittings and openings. It can be applied "in place." Uninterrupted continuity is obtained.

CENTRILINE Centrifugal Process. Cement mortar lining ingredients are mixed to rigid requirements and applied under a high velocity spray with uniform speed. Rotating steel trowels spread the mortar to a smooth, hard finish. Pipe sizes vary from 16" on up to 144". Clay, cement, brick, steel, cast iron and wrought iron pipes may be CENTRILINED.

plus SOMASTIC®

outside pipe coating which may be applied either at the central Wilmington, California, plant, or at railhead plants elsewhere.

PIPE LININGS

DIVISION OF AMERICAN PIPE AND CONSTRUCTION CO.

Write, wire or phone
2414 East 223rd Street, Wilmington, California • P.O. Box 457
Phones: NEvada 6-1771 — TErminal 5-8201
Rail Address: Pacific Electric, Watson, California

he was promoted to Assistant Foreman in 1945, Foreman in 1948 and District Superintendent in 1950.

In 1950, he became Executive Assistant to the Commissioner and on January 1, 1953, was advanced to Director of Operations, the highest career position in the Department. In 1957, he was appointed Commissioner, the youngest in the Department's history. In 1941 he enlisted as a private in the United States Army and advanced through the ranks. At present, he is a Colonel in the U. S. Army reserve and is assigned to a Civil Affairs Military Government unit.

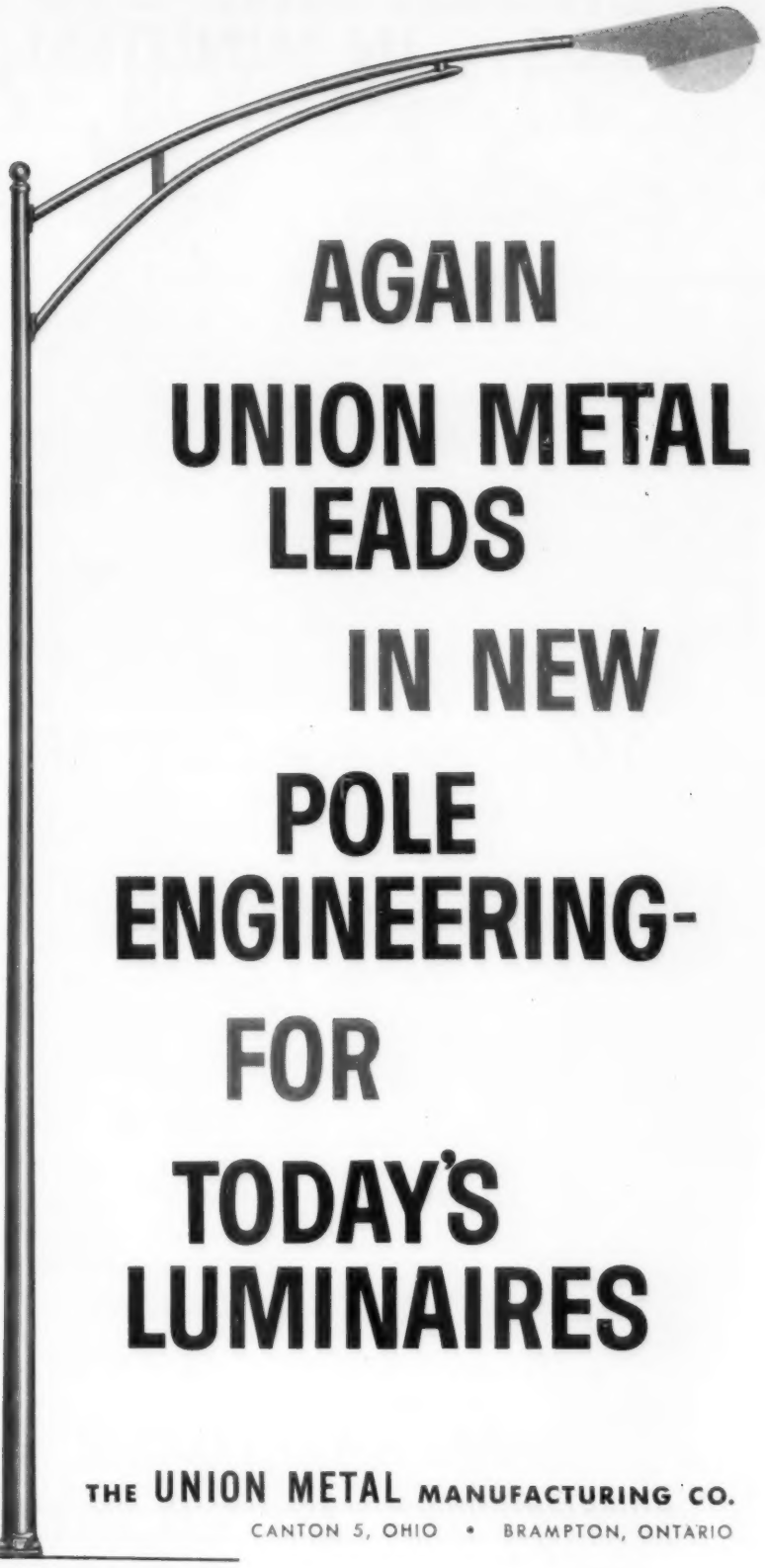
Albert G. Wyler, Director of Streets for the City of New Orleans, La., was re-elected Director of Region No. 4 which includes Arkansas, Louisiana, Mississippi, Alabama, Georgia and Florida. Mr. Wyler has been a member of the APWA Board since 1953 and has served as Secretary-Treasurer and Vice President of the Southern Area prior to the amendment to the constitution in 1955 providing for the present nine regional directors. He started his thirty-three years of service with the City of New Orleans as Assistant City Engineer and in 1955 was named Director of Streets. He holds a Bachelor's degree in Civil Engineering from Tulane University.

Edward J. Booth, City Engineer and Water Superintendent for the City of Bismarck, N. D., was re-elected Director of Region No. 6 which includes Manitoba, Canada, North and South Dakota, Minnesota, Iowa, Nebraska, Kansas and Missouri. Mr. Booth has been a member of the APWA Board since 1957 and has served the Association in various capacities. He was instrumental in the formation of the North Dakota Chapter of APWA and served as the Chapter's first president. He is a graduate of North Dakota State College and has been in the employ of the City of Bismarck since 1945.

The APWA Constitution provides that three of the nine Regional Directors as well as the President and Vice President shall be elected each year. The Directors of the other six have one or two years remaining of their three-year terms.

Thirty-Seven Cited for Service

Seattle, Wash. — Thirty-seven members of the APWA have been cited for their long and faithful service to their community; a special scroll was presented to each at the Association's 65th anniversary celebration held during the 1959



AGAIN UNION METAL LEADS IN NEW POLE ENGINEERING- FOR TODAY'S LUMINAIRES

Announcing

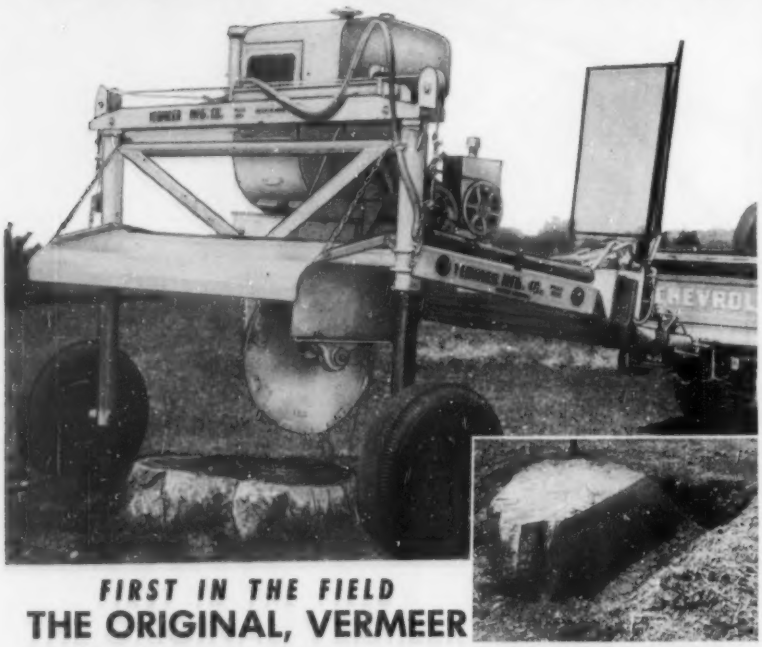
BULLETINS LS-29 AND LS-30 featuring steel and aluminum poles properly engineered to meet today's rigid roadway requirements.

Monotube poles have the required "built-in" qualities for supporting the latest in filament, mercury and fluorescent luminaires.

Monotube Engineered Poles

THE UNION METAL MANUFACTURING CO.
CANTON 5, OHIO • BRAMPTON, ONTARIO

RIPS WIDEST STUMPS TO SHREDS . . . IN MINUTES!

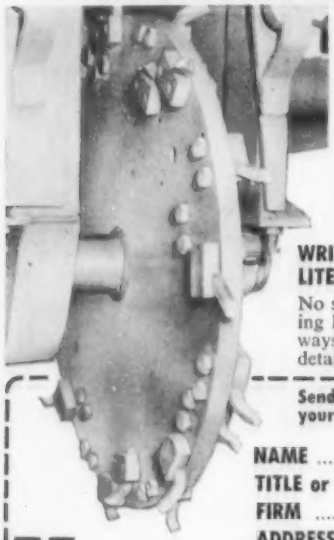


FIRST IN THE FIELD

THE ORIGINAL, VERMEER

POW-R-STUMP CUTTER

You'll never know how easy stump removal can be, unless you've seen the Pow-R Stump Cutter in action. Here's the machine that has simplified this expensive, back-breaking, laborious job in cities, parks, golf courses and cemeteries all over the country. A one-man operation . . . a real time saver . . . a real labor saver! The Pow-R Stump Cutter removes the largest tree stump — rips it to shreds down to a depth of 10" below the ground — all in a matter of minutes. "Removed 44 stumps in 8 hours with the Pow-R-Stump Cutter" . . . is the report from one city recently.



The Leader . . . 10 To 1 Choice Of Tree Experts Everywhere

The Vermeer Pow-R Stump Cutter was FIRST . . . the original stump remover. It's a quality machine, ruggedly built to take on the toughest, largest stumps. Cuts wider stumps (a full 72") and higher stumps (37" above the ground) at one setting! Operator has full view of cutting wheel at all times . . . behind wire mesh safety shield.

WRITE FOR COMPLETE ILLUSTRATED LITERATURE AND LOW PRICES NOW

No stump to be hauled away. No gaping holes to fill. No damage to driveways, curbs or sidewalks. Get all the details by mailing the coupon below.

Send complete descriptive literature and prices on your Pow-R Stump Cutter to:

NAME .....

TITLE or DEPT. .....

FIRM .....

ADDRESS .....

CITY ..... STATE .....

VERMEER MANUFACTURING CO.

1439 W. WASHINGTON ● PELLA, IOWA

Public Works Congress and Equipment Show.

The Citation, known as the Samuel A. Greeley Award, was established by Samuel A. Greeley of the consulting firm of Greeley and Hansen, Chicago, and is presented annually to those serving one municipality or governmental unit for thirty or more years in the public works field.

Recipients of the Award are:
Cletus E. Allen, Dubuque, Iowa
D. A. Andersen, Seattle, Wash.
Robert L. Anderson, Winnetka, Ill.
Eric A. Andrews, White Plains, N. Y.
C. W. Beardsley, Los Angeles, Calif.
Harry O'B. Bellinger, Columbia, S. C.
Ray Blessing, Kansas City, Mo.
Ernest G. Bruske, Stevens Point, Wisc.
John Busha, Marysville, Mich.
Curtis C. Colwell, Essex County, N. J.
Reginald C. Craig, Los Angeles, Calif.
James T. Davis, Fort Worth, Tex.
S. diBenedetto, New Orleans, La.
Ernest A. Fort, Miami, Fla.
S. G. Gentile, Detroit, Mich.
S. J. Greenberg, Philadelphia, Pa.
John F. Hagerty, Buffalo, N. Y.
John F. Hale, Dayton, Ohio
G. E. Hesselbacher, Cheltenham, Pa.
Earl O. Imus, Oxnard, Calif.
Arthur H. Koch, St. Paul, Minn.
Henry Leuning, Ridgewood, N. J.
Edmund H. Lindstrom, Seattle, Wash.
P. James Magliato, New York City
W. R. Marshall, Nashville, Tenn.
H. L. Medford, Greensboro, N. Car.
William N. Nolan, Buffalo, N. Y.
Willard S. Pratt, Newton, Mass.
N. M. Pritchett, State of Maryland
Percy B. Sprague, Valley Stream, N. Y.
Leslie M. Talley, Arcadia, Calif.
Robert B. Strong, Providence, R. I.
James J. Sullivan, Springfield, Mass.
William A. Trezona, Spokane, Wash.
Charles E. Vickerman, Philadelphia, Pa.
Milton F. Wagnitz, Detroit, Mich.
Col. A. W. Waterman, South Portland, Me.

Guidelines for Industrial-Waste Ordinance

A new APWA Special Report, "Guide-Lines for Drafting a Municipal Ordinance on Industrial-Waste Regulations and Surcharges" is now available.

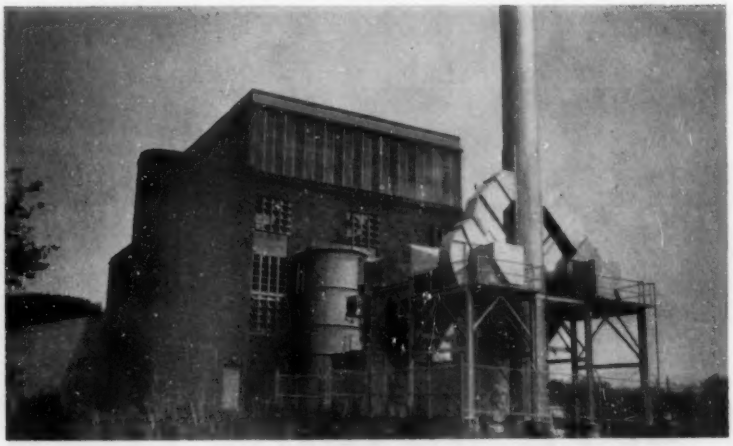
The 20-page report was prepared by Dr. Edward J. Cleary, executive director and chief engineer of the Ohio River Valley Sanitation Commission, who is one of the nation's foremost authorities in this field.

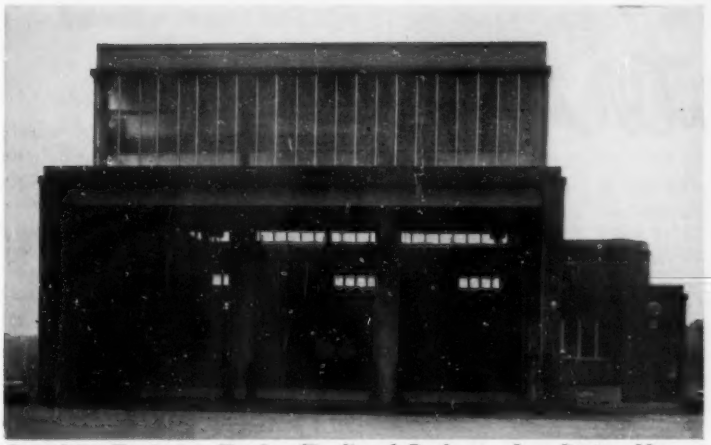
Municipal officials who are considering the adoption of regulations and surcharges for the acceptance of industrial-waste discharges will find this to be an exceedingly valuable guide. Recognizing that no municipal ordinance has universal application, the material has been written to include reasons why certain provisions are recommended, in addi-

MUNICIPAL INCINERATION BY MORSE BOULGER INC.

new . . . improved . . . startling!

The town of Belmont, Mass. is the first to have it!





THE TOWN OF BELMONT, MASS.
The new features shown in the equipment picture are the arrangement of cylindrical combustion chambers with spray towers, dust collectors and induced draft fans.

Consulting Engineers, Hayden, Harding & Buchanan, Inc., Boston, Mass.

Ask about . . . Vertical spray chambers for low cost fly ash elimination . . . two speed induced draft fans . . . new rotary stokers . . . non-clog dust collectors . . . readily accessible charging gates . . . smaller incinerator buildings . . . safety features and controls never used before for municipal incineration. Write for Bulletin 111-D—The Cylindrical Mechanical Stoker with automatic, continuous, positive stoking.

MORSE BOULGER INC.

Dept. AA — 80 Fifth Ave., New York 11, N. Y.

Representatives in Principal Cities

tion to outlining how they may be incorporated in the ordinance.

The author stresses the fact that it is not a substitute for the services of a sanitary engineer and legal counsellor. Rather, he says, "it should be looked upon as a compendium of experiences organized in a manner to reveal the form and content of basic elements of an ordinance."

Copies of Special Report No. 23 are available from the APWA headquarters office, 1313 East 60th Street, Chicago 37, Ill. It is priced at $3.00 per copy less 40 percent to members of the Association.

REFLECTIVE LICENSE PLATES

Michigan has joined seven other states in the trend to provide motorists with reflective license plates to make vehicles brightly visible to approaching motorists at night.

Reflective license plates, ordinary license plates surfaced with a sheeting which brightly reflects the headlights of oncoming cars back to the driver, provide each car or truck with a night safety device that works independently of the vehicle's lighting system. This quality is particularly important in reducing the danger of collision with parked or stalled cars.

Law enforcement officers find in reflective plates an additional advantage: for the first time, front license plates may be read at night even in the glare of the vehicle's headlights.

Reflective license plates are issued in Maine, Delaware, Louisiana, Minnesota, Wyoming, South Dakota and North Dakota. Alabama has reflectorized its commercial license plates; Iowa has a county-wide test in operation; and New York, Florida and New Mexico are using some reflective plates on a test basis.

Reflective plates make parked trailers, trucks, motorcycles and unlighted or disabled cars more visible to approaching motorists at night and also provide an extra safety margin for moving vehicles with defective lights. In addition to accident-prevention benefits, they help policemen intercept "wanted" cars by increasing license plate readability.

Reflectorizing Methods

There are two methods by which license plates are reflectorized, both of which are accomplished through the addition of a relatively inexpensive applicator to existing equipment. The plates may be surfaced with reflective sheeting, or coated with reflective glass beads. Reflectorization is done at the point of manufacture; in most states, this is the state penal institution.

Two major suppliers in the reflective license plate field are Minnesota Mining and Manufacturing Company for reflective sheeting ("Scotchlite"), and Prismo Safety Corporation for bulk glass beads ("Prismo"). Three states (Louisiana, South Dakota and Wyoming) use a reflective bead system; the other five use reflective sheeting.

Reflectorization for license plates costs up to 28 cents additional per plate, depending upon the treatment. In general, the brighter and more durable the reflectivity, the more it costs. An extremely durable reflective sheeting is available for states with "permanent" plates—such as Maine, which uses the same plates for five years.

ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
PHELPS DODGE REFINING CORP.
CHEMICALS

Likes the TL-20 because it's

MODERN, VERSATILE, RUGGED

With 325 miles of northern Illinois roads to look after and a budget to watch, Field Superintendent H. B. Brown, of Winnebago County, makes sure the equipment he has is modern and efficient in every respect.

He points out his TL-20 TRACTOLOADER as a good example because it is fast, does all kinds of jobs in the yard or out on the network of roads — and it's rugged.

Here are some of the jobs the TL-20 handles and the reasons it does 'em so well.

LOADS TRUCKS — Operator goes into and out of any gear at will with one lever — shortens loading time by using fastest gear working conditions allow. One-lever speed and direction control is an Allis-Chalmers exclusive!

STOCKPILES — Low carry and extra stability means no spilling and tipping — extra operator comfort.

CLEANS DITCHES — Tip-back bucket follows ditch without gouging banks or altering contours.

EXCAVATES — Digs into hard-packed material with bucket teeth . . . even handles the more demanding excavating jobs.

QUARRYING — Tears out rubble in quarries. Pin-connected planetary axle and one-piece welded frame proves itself in rough going.

OFF SEASON — During winter months, the TL-20 is a big help on snow removal and loading salt, cinders, crushed stone. In the spring, it digs out frost boils from the black top.

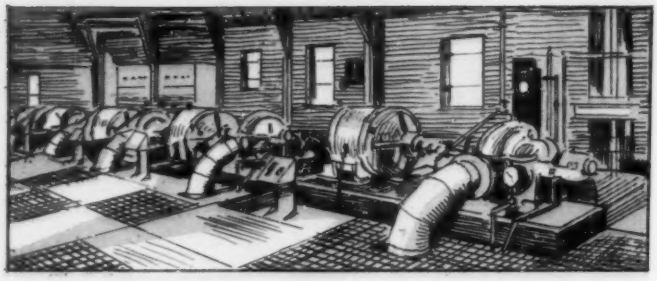
Want budget-beating performance on your work? Let your Allis-Chalmers dealer show you the TL-20 in action. There's a whole family of buckets to choose from — 2¼ to 5 cu yd. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

TRACTOLOADER is an Allis-Chalmers trademark.

move ahead with ALLIS-CHALMERS

... POWER for a growing world

THE
WATER WORKS DIGEST



Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

Insecticide Pollution

Since 1940, synthetic organic insecticides have come into general use until in 1957 it was estimated that between 11,000,000 to 25,000,000 lbs. of these chemicals (technical grade) were applied to the cotton crops of six southeastern states alone. It is suspected that a substantial quantity of the stable, chlorinated hydrocarbon insecticides—namely aldrin, BHC (benzene hexachloride), DDT, dieldrin, endrin, heptachlor, and toxaphene, are the insecticides that have the greatest potential for damaging water resources. These chemicals after their application to farm crops are washed from the soil surface into streams and lakes, where serious damage may result to water resources, particularly to fish and other aquatic life. The effects of DDT on humans have been evaluated thoroughly, but a more complete evaluation of the effects of other insecticides on water quality for human consumption remains to be made. Generally speaking, however, it may be concluded that if insecticides are not present in a stream or lake in sufficient quantities to kill fish, there will be no known significant public health hazard due to insecticides in drinking water from these sources.

"Insecticide Pollution of Water Resources." By H. P. Nicholson. *Jour. A. W.W.A.*, August, 1959.

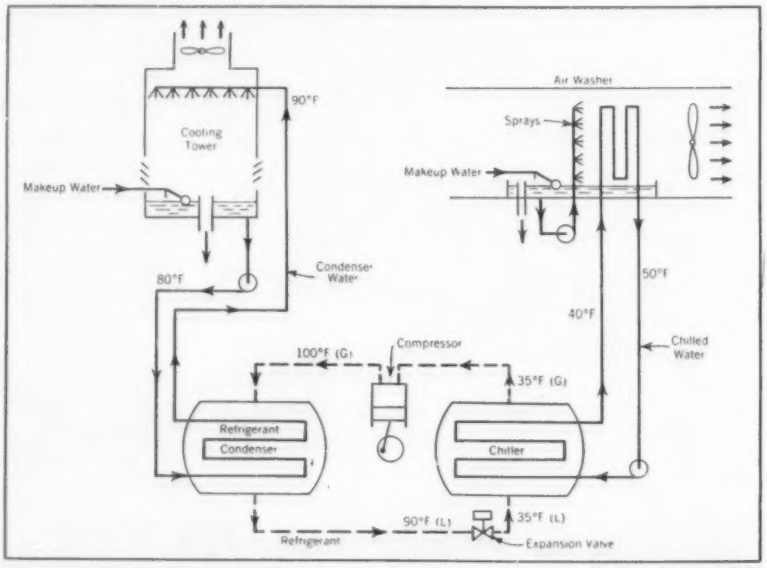
Air-Conditioning Water

With the increased use of cooling towers and evaporative condensers in small commercial air-conditioning installations, water-caused troubles are now plaguing businessmen who have had no previous experience with such problems. With the once-through type of cooling system, the water composition scarcely changes other than a small increase in metal ions resulting from corrosion, or a slight loss of hardness and alkalinity, resulting from scale formation. In theory, no significant changes should be caused by circulating water in the closed chilled-water systems used in the larger central air conditioning installations. However, large amounts of make-up water are needed in many of these systems because of water losses from a variety of causes. The more make-up water in closed systems, the greater the chance for changes in water composition. The accumulation of corrosion products is the most frequent change observed. The authors also discuss in a thorough manner, citing several examples, the effects of acid or alkaline gases absorbed from the air which result in corrosive or scale forming waters in the air conditioning systems. Circulating waters also scrub many solids from the air, including bacteria, algae spores, and airborne dirt, all of which have significant effects upon the operation and life of air-conditioning equipment.

"Water Composition Changes in Air Conditioning Equipment." By S. Sussman and I. L. Portnoy. *Jour. A.W.W.A.*, August, 1959.

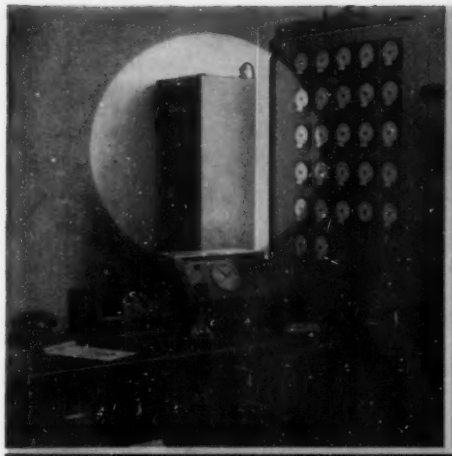
Cementing Water Wells

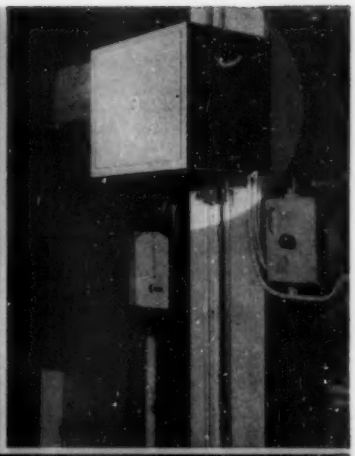
In this article the author discusses techniques and materials which will aid in obtaining maximum control of isolating the producing zone or zones in individual wells. Isolation is desirable to protect the producing water-formation from contamination from less



Courtesy Journal AWWA

● **AIR CONDITIONING system above is typical, but not every system includes all the components shown. This system maintains humidity at an almost constant level.**

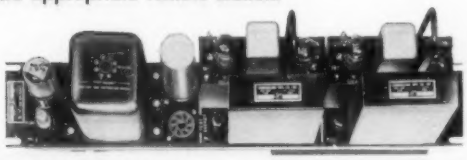




Hammarlund COC tone signalling cuts operating costs

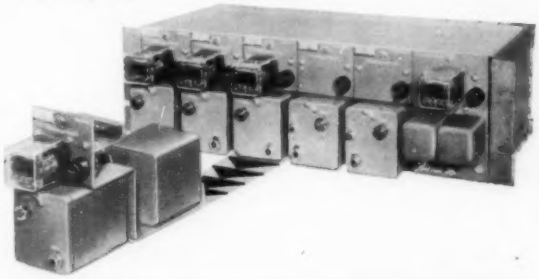
In thousands of installations, every day and in every way, Hammarlund Tone Signalling is proving its dependability, accuracy and outstanding economical operation.

Hammarlund COC Tone Signalling provides Centralized Operations Control, transmitting all information from any point or points in a system to a central control station. Simultaneously, it provides the transmission of control for any function from the central station to the appropriate remote station.



STANDARD UNITS — Tone generators, transmitters, and receivers in complete modular design. Unique plug-in modules, plus built-in test sockets, and standardization of modules permits fast, easy field maintenance by non-technical personnel. Every standard Hammarlund Tone Unit is complete in itself with built-in power supply for complete flexibility or expansion of the system at any time.

COC Tone Signalling may be done over leased public telephone lines, private lines, or via radio links. It operates with all standard instrumentation and powered equipment such as motorized valves, pumps, starters, etc.



AND NOW, COMPLETELY TRANSISTORIZED TONE —The most advanced transistorized tone signalling ever offered. The result of years of exhaustive lab and field testing. Completely modular. Test socket permits non-technical personnel maintenance. A single type, plug-in transistor used throughout system. Completely flexible for system revision or expansion. May be used in conjunction with standard Hammarlund tone units. Can operate on available DC. Emergency power failure battery operation.

MAKE US PROVE COC TONE SIGNALLING CAN SAVE YOU MONEY . . .

WRITE FOR COMPLETE DETAILS . . .

HAMMARLUND

Established 1910

THE HAMMARLUND MANUFACTURING COMPANY, INC.

460 West 34th Street, New York 1, N. Y.

desirable strata or from the surface. The use of cementitious materials, such as portland cement, bentonite, perlite, pozzolans, diatomaceous earth and gilsonite, will provide the most effective means of effecting this isolation, will permit techniques of stimulations requiring hydraulic pressure and fluids, and will help to protect casing against corrosive waters. To date portland cement has been the most widely used. One problem which may arise during the cementing operation is that of mud contamination. This problem may be minimized by the use of the two-plug system so thoroughly discussed by the authors.

"Cementing Water Wells." By B. D. Brown, PUBLIC WORKS, September, 1959.

Flow Meter Repair Shop

After a careful analysis using standard time-study techniques, the Commonwealth Water Co., Summit, N.J., has completely redesigned its meter repair shop. This company supplies water principally to residential communities and because of this fact well over 95% of the meter repair work is on ⅝" meters. For this reason, the shop was designed with this fact in mind. The underlying thinking in the design of the new meter shop was based on these principles: 1) Insofar as possible, all work was brought to the individual mechanic. 2) Specialization in work was demanded. 3) All dirt and odors were kept in an isolated room. 4) The various steps in meter repair and test were placed in logical sequences. The quality and quantity of individual mechanics work should be measurable. The article includes a series of photographs showing each of the several steps in proper sequence in the repair of the meters in this new shop.

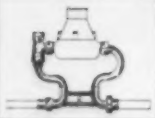
"Continuous Flow Meter Repair Shop." By T. W. Coleman. *Water & Sewage Works*, August, 1959.

A Water Supply in the Clouds

The City of Boulder, Colorado, boasts a water supply which has as its source the Arapahoe Glacier, located at the 10,000 to 12,000 foot elevation in the Rockies, just east of the Continental Divide. The water is soft and low in mineral content, coming from the snows and rains at this high elevation in the Rockies. Snow depths of 90 inches are not uncommon. Two series of dams in the watershed empty into Silver Lake which supplies the City of Boulder as well as irrigation rights. One of the biggest problems is regulation of the water supply. With an estimated population of 35,000 people, water use runs about 4 mgd in the winter months to 18 mgd in late June and early July. A combined reservoir capacity of 30 mg is available and efforts are made to refill the reservoirs on a 24-hour basis. Sprinkling is restricted in normal years to alternate days, not by reason of shortage but to reduce the drawdown on the system. During times of shortage, the city must restrict use by invoking definite sprinkling hours to conserve the supply. The distribution system operates at from about 50 pounds to 200 pounds static pressure. No pumping is required and no large users have quick-operating valves, so the pipes stand up well at these pressures. Approximately 1 ppm chloramine residual is sufficient to provide a safe water. The author describes these and several other problems of this high mountain water supply.

"A Water Supply in The Clouds." By C. M. Dixon, *Water Works Engineering*, August, 1959.

Why it is PROFITABLE to use FORD products

Meter men know their settings		**1. You Standardize Your Settings** Regardless of the model, Ford yokes and setters provide standard, permanently aligned settings. No time lost trying to "rassle" around with the odd ones.
	Keep your meters on the level	**2. You Set Meters Horizontally** No matter how the water line runs—horizontally, vertically, in a corner or diagonally, Ford settings keep your meters level for most efficient operation.
Change a meter in a few moments		**3. You save on Meter Changes** Meters set in Ford yokes or setters may be removed and replaced quickly and economically. The time saved on one meter change may more than pay for the setting.
	50 years or more in one place	**4. Inside or Outside - Settings are Permanent** Whether you have basement or outside meters Ford settings are good for the life of the service.
Do you use shallow settings?		**5. Adaptations for Every Climate** Ford shows you how to get the best settings for your climate—and provides all the equipment, even to meter boxes, barrels, forms and covers.
	Be sure you are paid enough	**6. Complete Testing Equipment** Ford bench or portable testing equipment helps you keep meters operating efficiently so that you get paid for all the water you deliver.
You get the breaks on new inventions		**7. Ford Research Keeps You Out in Front** For over 60 years Ford has specialized in developing and producing better equipment for setting and testing water meters. Stay "out in front" with Ford.

FOR BETTER WATER SERVICES

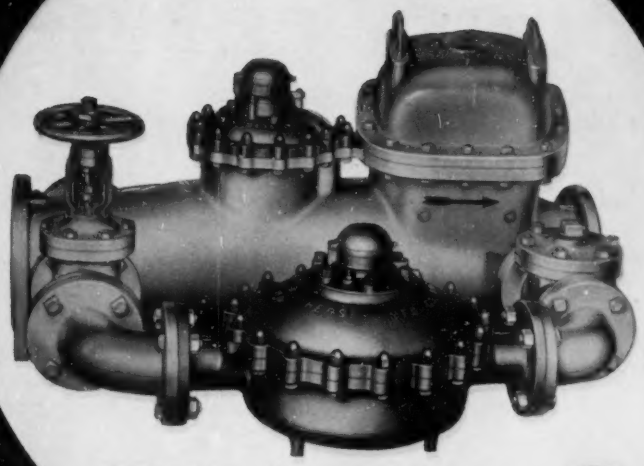
FORD

THE FORD METER BOX COMPANY, INC.
WABASH, INDIANA

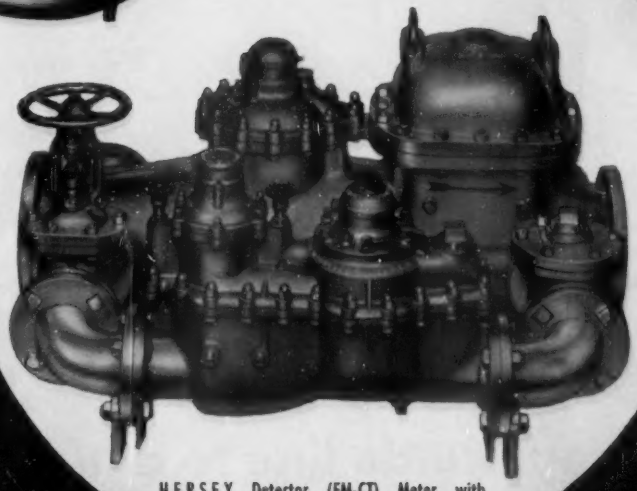
HERSEY

DETECTOR (Fire Service) METERS

Are available in Two Types — shown below



HERSEY Detector Meter with Disc Meter on By-Pass



HERSEY Detector (FM-CT) Meter with All-Bronze Compound Meter on By-Pass

For your own protection it is wise to install

HERSEY

Detector (Fire Service) Meters on all industrial fire service lines

Call our nearest Branch Office for detailed information

HERSEY MANUFACTURING COMPANY

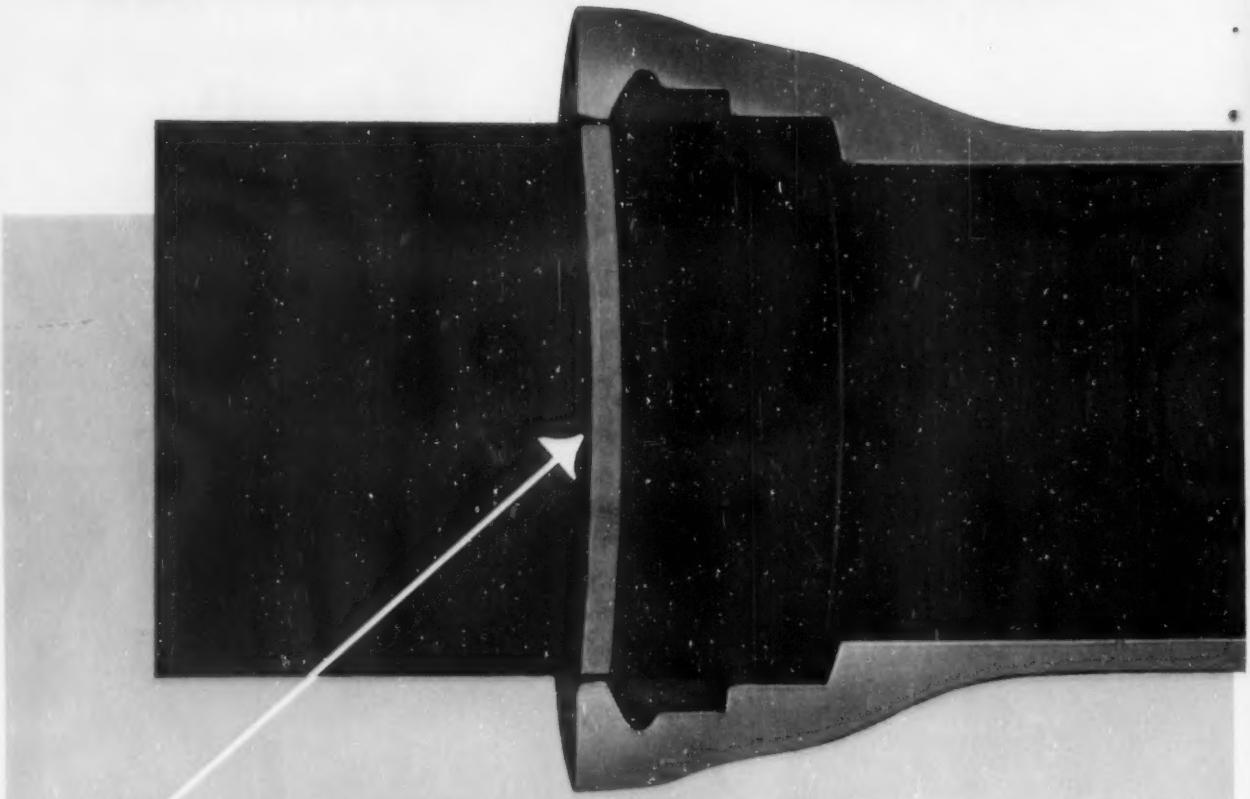
(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

YOU CAN'T BUY A BETTER WATER METER THAN HERSEY

CLOW



This YELLOW STRIPE on

CLOW Bell-Tite Joint Pipe

is your guide line to a quick bottle-tight seal

This circular yellow stripe is painted on the plain end of each length of CLOW Bell-Tite Joint pipe. It serves as a guide in making up the joint, to provide a fast, positive visual check that the the joint is completely and correctly assembled.

The edge of the stripe farthest from the plain end measures approximately one-half inch less than the depth of the Bell-Tite bell. Thus, in assembly, the joint is made pressure-tight when the stripe is no longer visible.

The seal is achieved by the use of a single, thick-section, high durometer molded rubber gasket. When compressed in position by the entering plain end of pipe, it forms a pressure-tight seal with generous sealing area which permits ample deflection to meet casual curves or grades.

CAST IRON

with patented* Bell-Tite Joint

*Patent No. 2898131

MORE MAIN FOR YOUR MONEY

Costs less to buy

Only one accessory is required to make a pressure-tight seal with a CLOW Bell-Tite Joint —a single, molded rubber gasket. There are no extras—no bolts, no nuts, no followers, no couplings. This economical pipe is strong, tough, uniform and durable for long-life underground service. It is available in any specified thickness or weight class in accordance with ASA, AWWA, or Federal specifications from 3″ to 24″.

Costs less to install

Assembly is quick, simple and easy. Pressure-tight joint is formed instantly by merely inserting the rubber gasket and pushing the pipe home to its seat. It can be installed in a wet trench and even under water. Rate of installation usually is limited only by speed of excavation. It permits ample deflection for casual curves or grades. Bell-Tite Joint pipe is Underwriters' Listed for working pressures up to 350 psi. Available in diameters up to 24″.

CLOW CAST IRON PIPE

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company
Waterford, N.Y.

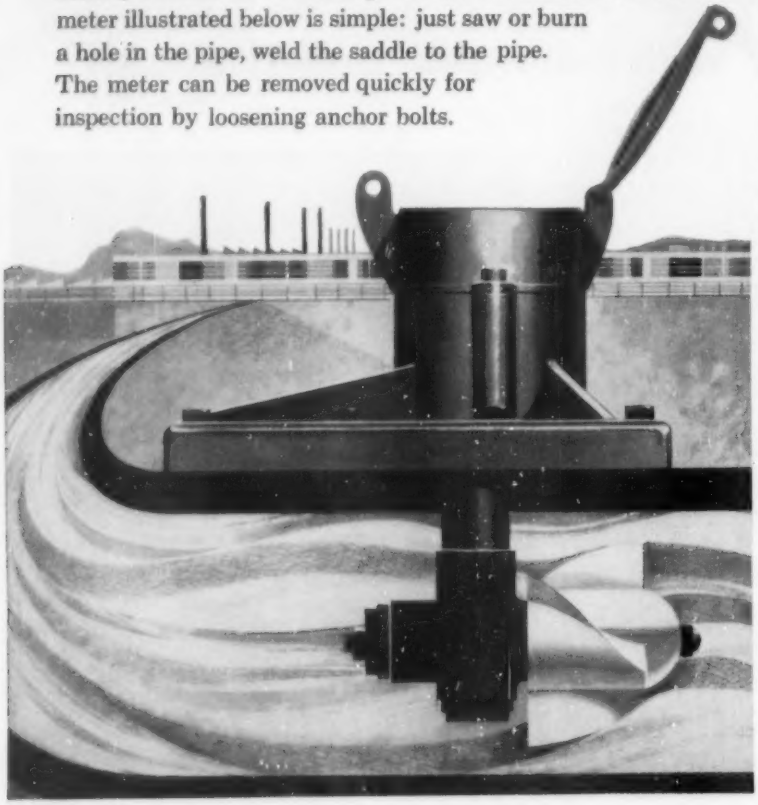
Iowa Valve Company
Oskaloosa, Iowa

Increase efficiency and water profits with

MEASURE-RITE propeller meters

Measure-Rite meters can be installed on new or existing lines . . . for accurate, dependable water metering control.

They will register accurately whether mounted in horizontal, vertical or *inclined* positions. Installation of the meter illustrated below is simple: just saw or burn a hole in the pipe, weld the saddle to the pipe. The meter can be removed quickly for inspection by loosening anchor bolts.



Free flow design
assures low loss of head

In the Measure-Rite assembly, the propeller is positioned *forward*, fully centered in the metering chamber for greater metering accuracy. Free flow design provides least restriction of flow — minimizing loss of head.

Send for Bulletin MR-105 describing the complete line of Measure-Rite propeller meters. Address inquiries to:

MEASURE RITE, INCORPORATED

A Subsidiary of BADGER METER MFG. CO.
4545 W. BROWN DEER RD. • MILWAUKEE 18, WISC.

Dual-Purpose Water Program

A dynamic illustration of the effectiveness of water planning is the recent expansion of separate industrial raw-water pumping and Cherokee Hills treatment facilities by Savannah, Ga. The domestic water demands of the city have been supplied by artesian wells since around 1880 through an effective development program. To furnish an adequate source of industrial water the city decided to develop a separate industrial supply. All that was found necessary to supply this needed water was a comparatively inexpensive $440,000 program of increasing facilities at the Cherokee Hill Plant and the Abercorn Creek Station from 40 mgd to a potential of 50 mgd. The plant receives raw creek water, which is high in bacteria, suspended solids, color and sediment, where chlorine, lime and alum are added. The dosed water is passed into flash mixers, then into flocculating and settling basins where 4 hours of retention time is provided. After filtration, the water is stored in one of the storage tanks providing the plant with 16 million gallons of storage capacity.

"10-Mgd Expansion Strengthens Dual-Purpose Water Program." By Bruce Sams. *The American City*, August, 1959.

Other Articles

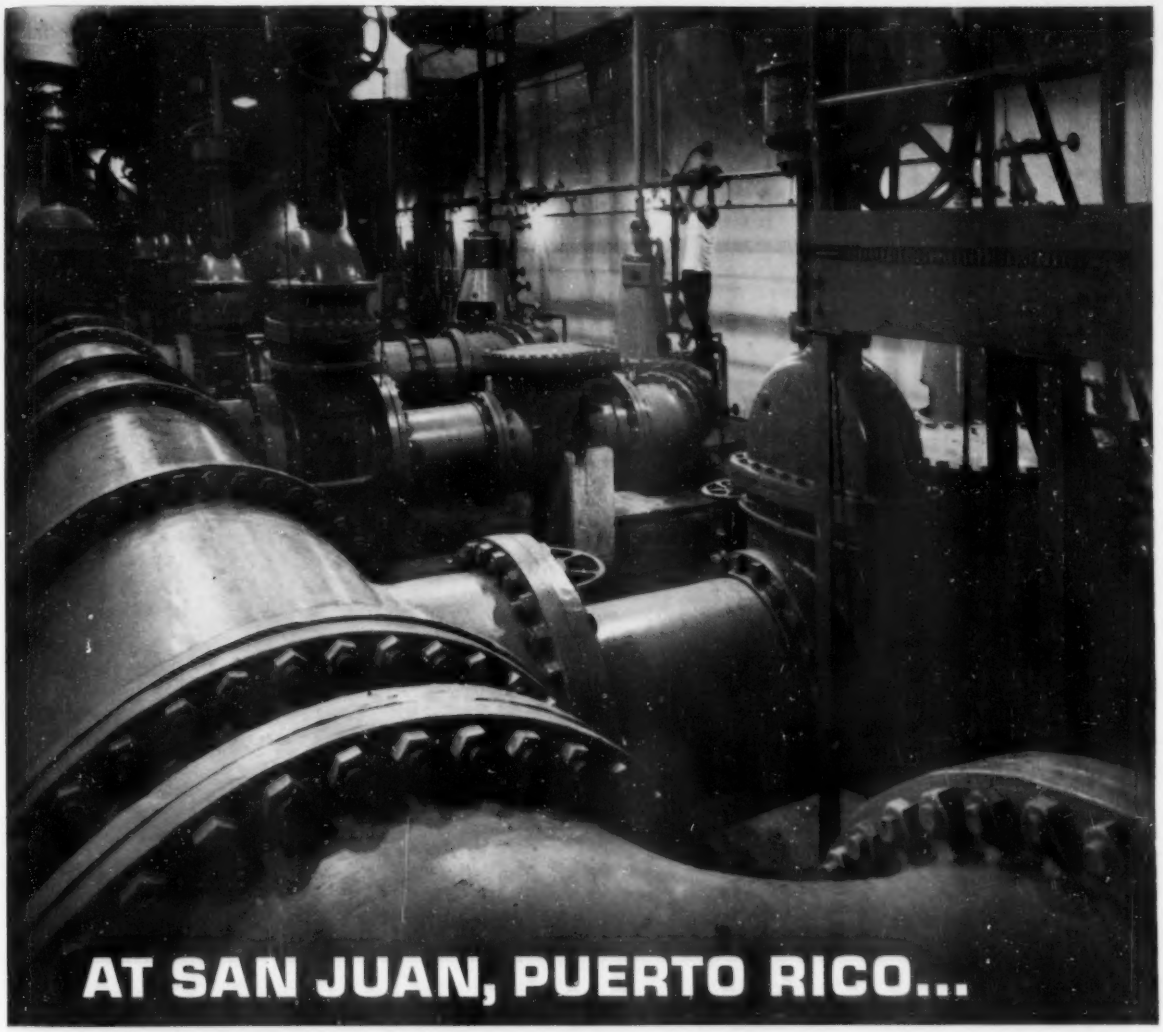
"Water Analysis by **Neutron Activation.**" Neutron activation analysis, based upon controlled exposure of samples in a nuclear reactor, may considerably broaden and extend the knowledge about elements in water. By R. L. Blanchard, G. W. Leddicotte, and D. W. Moeller. Jour. A.W.W.A., August, 1959.

"Salvaging Heat from Modern **Recarbonation** Equipment." Salvaging the heat of carbon dioxide production results in a net saving of $3,749 in annual heating costs at Kansas City, Mo. By G. E. Hands and J. R. Popalisky. Jour. A.W.W.A., August, 1959.

"Check List for **Water Treatment Plant Design.**" This check list is intended as a basic approach to the problem of ease and operation and maintenance of facilities. By David P. Green. Public Works, September, 1959.

"**Coagulants**, Their Selection." How a coagulant is selected for a particular water problem. By Marvin Lane. Water & Sewage Works, August, 1959.

"**Valve Selection** for Water and Sewage Service." Some of the factors and considerations which should be studied and weighed carefully by the designer before making any valve selection. By H. H. Benjes. Water & Sewage Works, August, 1959.



DARLING VALVES GET THE CALL

in new high capacity sewage treatment plant

Shown above is the main pump room at the new Puerto Nuevo sewage treatment plant in San Juan, Puerto Rico... designed to serve nearly 600,000 persons by 1975.

Here, Darling Valves are on the job... ranging in size from 3" to 48". Darling's exclusive *fully revolving double disc parallel seat* feature and "no pocket" discs provide positive sealing and assure ease of operation.

As in cities throughout the U.S., Darling Valves "get the call" because of their reputation for outstanding quality and long, trouble-free service life. Tell us about *your* requirements.

DARLING
DARLING
VALVES

DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford, Ont.

YOUR BEST BUY

for top performance, long life, low upkeep . . .

Leopold

WATER PURIFICATION AND FILTER PLANT EQUIPMENT

Whether adding new plant capacity or modernizing present facilities, it pays to use Leopold Filter Plant Equipment. Leopold products can't be beat for efficiency, long life, and overall economy. Any way you judge them, they're your best buy. Just mail coupon below for details.

LEOPOLD FIBERGLASS-REINFORCED PLASTIC WASH TROUGHS

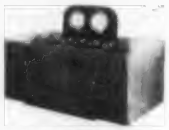
• Require no painting or other maintenance • Easy to handle —inexpensive to install • Resist weather, last indefinitely • For all design requirements • Also ideal for weir plates, collector troughs, baffles, etc.

LEOPOLD GLAZED TILE FILTER BOTTOMS

• Permanent • Can't corrode • Acid and alkali-resistant • Not subject to tuberculation • Proved in over 375 plants with a daily capacity of over 2¾ billion gallons.

LEOPOLD RUBBER-SEATED BUTTERFLY VALVES

• Provide positive bubble-tight closure • Designed for quick installation, easy operation, minimum upkeep.



LEOPOLD FILTER OPERATING TABLES

• Over 2000 in service • Standard or special models for individual needs with electric, hydraulic or pneumatic indicators. Also hydra-pneumatic control systems.

LEOPOLD DRY CHEMICAL FEED MACHINES

• Available in three capacities for volume batch feeding of dry chemicals.

MAIL COUPON TODAY FOR LITERATURE—COMPLETE DETAILS!

F. B. LEOPOLD CO., INC.
Zelienople, Pa.

Gentlemen:
☐ Please send literature on complete line of Leopold products.
☐ Please have representative call.

Name _____
Affiliation _____
City _____ Zone _____ State _____

Sewer Rental Programs in Pennsylvania

A STUDY of sewer rental programs in 48 western Pennsylvania communities has been made by the Institute of Local Government of the University of Pittsburgh. Of 48 communities, 17 base charges on water consumption; 8 on water consumption and a flat rate; 4 on water consumption and meter size; 5 on a flat rate basis; and the others on various combinations of consumption, character of property served, size of meter, number of plumbing fixtures, etc. The charges are collected quarterly by 32 communities, monthly by 9 and at various intervals by the others.

As indicated above, the basis for charging most widely used is water consumption, but several municipalities use more than one base. In such instances, the rental is usually based on water consumption and the size of the water meter or where the water system is not entirely metered, a flat rate is assessed. None of the reporting units base rentals on the value of the property served and except for industrial surcharges assessed by several communities, the character and volume of sewage is not used as a base for determining special sewer charges.

Minimum rate charges are quite common as are permit requirements and tap-in fees. The amount of tap-in fees assessed users varies considerably from community to community and in some instances within a given political jurisdiction. Several political subdivisions assess industrial and commercial users higher connection charges than are imposed upon residential or domestic users.

Exemptions from sewer rentals are not granted widely. Only a limited number of municipalities exempt any of the various classes of users from the payment of these special charges. A church is the one institution most frequently exempted from sewer rental payments. Other types of users enjoying the benefits of exemptions are volunteer fire companies, public hospitals and public libraries. One municipality grants charitable institutions a reduced rental rate.

Adjustments for water not discharged into sanitary sewer systems are authorized by many of the communities. These adjustments are made primarily for industrial and manufacturing concerns; however, a few political subdivisions sanction adjustments for domestic users. Normally adjustments are authorized only when the user installs and maintains at his expense an approved device for measuring the amount of waste water entering the sanitary sewer system.

Only 12 of the 48 reporting agencies offer a reduction in the amount of the bill to the users who meet their obligations on time. On the other hand, a policy requiring the assessment of penalty and interest charges for late payment of sewer bills has been adopted by the majority of the political subdivisions.

In handling their delinquent accounts, the political subdivisions generally follow one of two procedures: shut off the water supply of a delinquent user or place a lien against the property. In several instances both methods of enforcing payments are used.

Sewer rental rate schedules for the communities studied are included in the 70-page booklet which is available from the Institute of Local Government, University of Pittsburgh, Pittsburgh 13, Pa., for $2 per copy.

• • •

Electronic Information System at Milwaukee

(*Continued from page* 109)

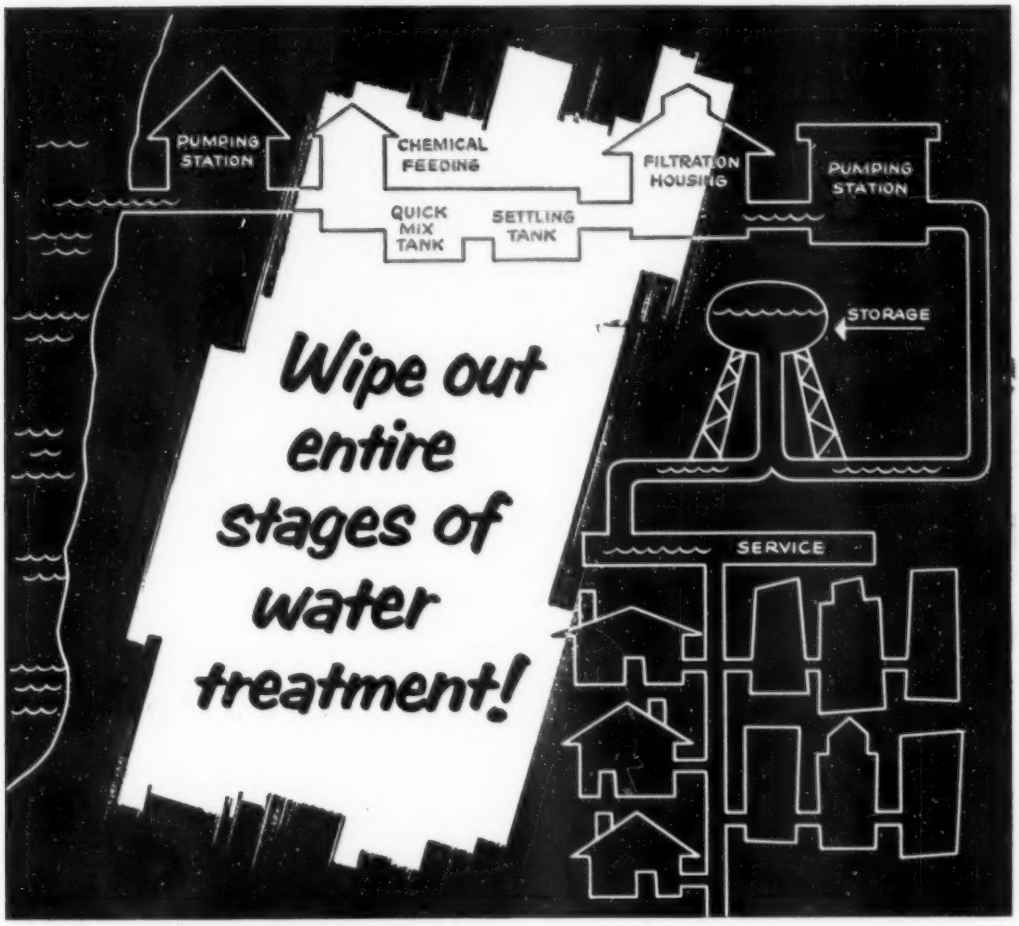
to simplicity and accuracy. Usually, the more complex a given system, the higher the cost. Also, the higher the degree of accuracy the greater the cost.

One of the most important engineering factors determining choice of specific instrumentation was the fact that signals were to be transmitted from the remote stations to the central operations center over telephone lines. This dictated that signals lie in the range of human audibility. Since Hammarlund Manufacturing Company is a recognized leader in the field of audio tone telemetry, their equipment was chosen. Naturally, the use of an audio tone telemetering system had a bearing on the choice of instruments.

Telemetering Equipment

The signals from the various F & P measuring instruments are transmitted electrically to the Hammarlund Tone Transmitters (with the exception of the V/A Cells which are first totalized and the totalized signal transmitted). There are eighteen transmitters, in all, located at the twelve remote stations. Fourteen are dual channel transmitters and four have a single channel. Since thirty points are being monitored at present, two channels remain available for future use.

The transmitters generate an



A complete Celite diatomite filtration system can eliminate the costs of conventional pre-treatment facilities

Now you can do something about skyrocketing per capita water consumption costs—as are dozens of municipalities every year. And get clearer, sparkling-bright water in the bargain!

Install one of today's small compact diatomite filtration plants, using Celite* filter aids. In many cases, raw water can be filtered directly, eliminating several of the costly conventional pretreatment stages—flocculation, quick-mixing tanks, and settling tanks, for example.

Result†: Filtration plants requiring only ¼ the space of sand plants of equal capacity. Capital costs cut almost in half—savings of up to 45%.

Here's why. Celite diatomite filters better than any other medium. Every cubic inch of the skeletal diatomite particles contains millions of microscopic filter pores. These are so minute they remove all suspended solids, including amoebae and algae, without flocculation.

Mined by Johns-Manville from the world's purest commercially available diatomite deposit, Celite is carefully processed for uniformity. You have a wide choice of grades for best balance of clarity and flow rate. For further information, call your nearby J-M Celite engineer. Write direct for free technical reprints and illustrated brochure. Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

* Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

† See *Comparison Studies of Diatomite and Sand Filtration* by G. R. Bell, Journal American Water Works Association, September, 1956, or write for free reprint.

JOHNS-MANVILLE JM

audible tone pulse (or in the case of the dual channel transmitters, two tone pulses), the length of which is determined by the Pulse Time Transmitter. These pulses are amplified and transmitted from the remote stations to the central operations center. In the present system, a single pair of telephone lines is used to transmit the information from each station.

Control Center Equipment

At the Control Center the tone signals are received from the twelve remote stations and read out in the form of a typewritten record. Equipment installed at the Control Center consists of:

a) Thirty Hammarlund tone signal receiving units, each preset to the exact frequency of the transmitter with which it is "mated."

b) The Fischer & Porter Series 1200 Data Logger, which is a complete data reduction system for automatically scanning, measuring, memorizing, and reading out process variables as digital values. The logger reads out automatically at preselected intervals, or readout can be initiated at any time simply by pressing a button. If desired, the logger can be set for continuous readout over and over with no time lapse between readouts. The F & P logger features a pinboard program selector in which the position of the pins determines the sequence of readout, the mathematical functions applied to each, the number of times a given point is read in a given time period, points monitored for alarm conditions, high and low alarm settings, and other logging characteristics. The system presently logs information on thirty variables emanating from twelve remote stations; however it can be economically expanded to one hundred points simply by the use of additional plug-in sub-assemblies.

How the System Works

The big advantage of the new Information System is that it provides a centralized, simultaneous record of all critical points in the Milwaukee water system. Information is transmitted almost instantaneously and data are read out in typewritten form on a single log sheet. Thus, where it used to take up to 24 hours to learn of an undesirable condition, water works officials now are alerted almost immediately and can take corrective action.

Since all points appear simultaneously side by side on the log sheet, the department has a true comprehensive picture of what is going on in the Milwaukee water system.

Not only does this help keep the presently overloaded system functioning smoothly, but it is anticipated that the hour-by-hour record of the functioning of the water system will prove extremely useful. Analysis and correlation of these records should provide much valuable data.

It is expected that, with the aid of the data logging equipment the water utility will be able to provide better service to its customers.

• • •

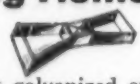
Using Soil-Cement for Reservoir and Lagoon Linings

THERE ARE three major functions of soil-cement linings for reservoirs and sewage lagoons: 1) Reduction of permeability of the soils in the bottom and embankments; 2) strengthening of the embankments or dikes to withstand wave action on the inside or flood damage on the outside; and 3) pro-

STAINLESS STEEL
Well Casing to meet every Soil Condition

from 6" to 36" diameter and 4 different perforations to meet your special requirements. For a permanent, trouble free well put down Thompson Stainless Steel Casing.

Parshall Measuring Flume



Accurate to .02 regardless of stream velocity, self cleaning, easily read, approved by State Engineers. 6" to 12' throat widths galvanized or black. Ideal for water and sewage control.

Automatic Control Gates

Control water levels, upstream or downstream, assures equitable distribution 24 hours a day . . . entirely self operating . . . no gate keeper necessary. Prevents costly washouts and flood damage. Proven in USA, Europe and Africa. Write for full information . . . there may be an automatic gate near, for your inspection.

Ask for catalog on TP 9-6

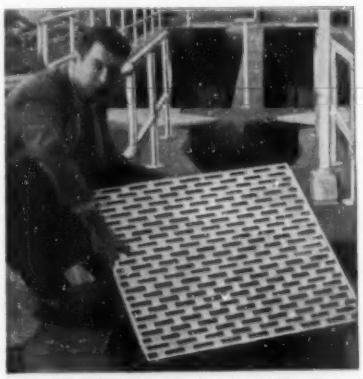
☐ Well Casing ☐ Parshall Measuring Flumes
☐ Custom Fabrication ☐ Automatic Water Control Gates

THOMPSON PIPE & STEEL CO.
3025 Larimer Street Denver 1, Colorado

WACO® T.M. REG.

ALUMINUM WALKWAYS ARE SAFE, MAINTENANCE-FREE

Non-Corrosive, Strong and Durable—They are Valuable Assets in Water and Sewage Plants

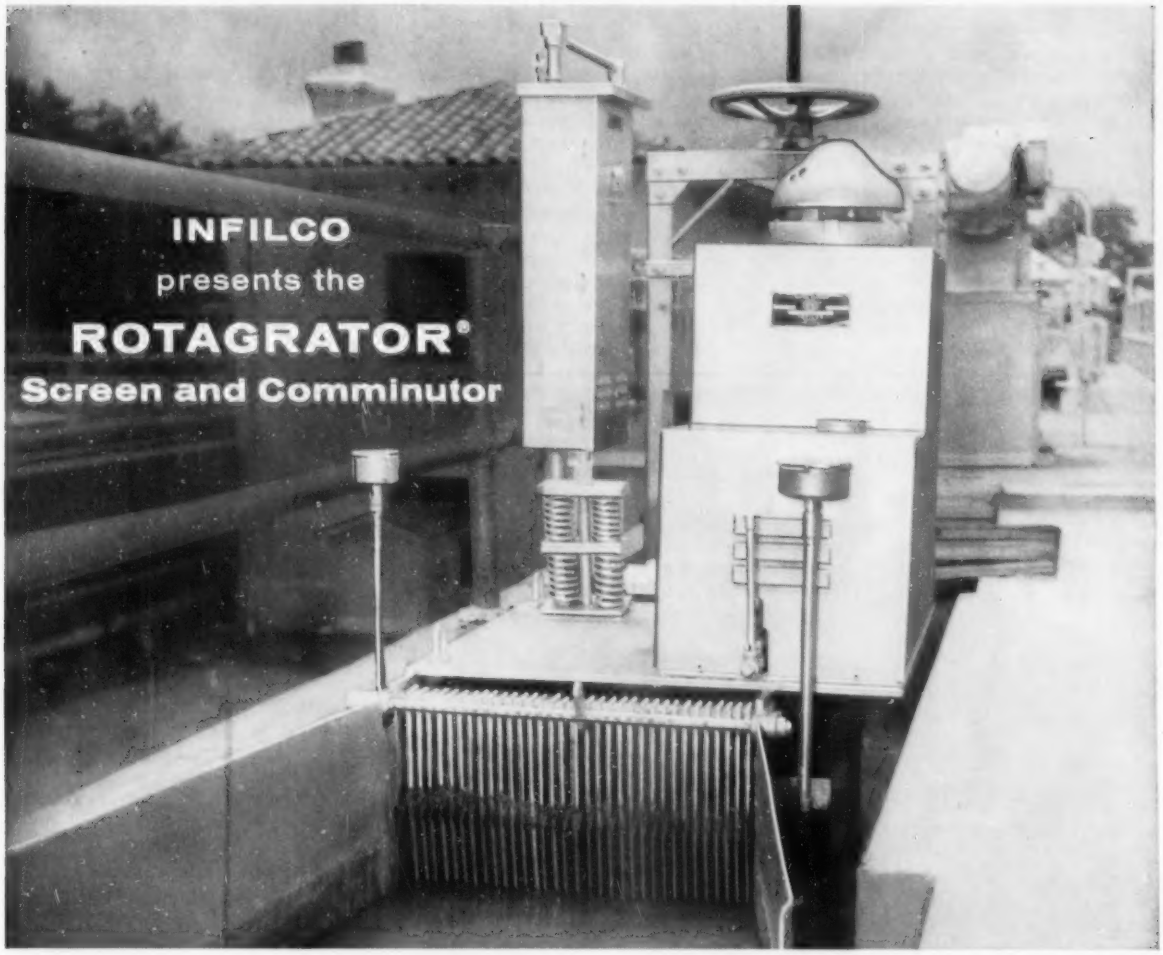


George H. Hill, Washington Aluminum's New England representative, points out the grating's patented perforation pattern.

Washington Aluminum Walkways *provide* a lifetime of maintenance-free service — never need painting, resist rust and corrosion, provide ventilation. Their strength lies in the I-beam extrusion.

Washington Aluminum fabricates grating and other installations to specification. Consult our Engineers at point of planning. No charge —no obligation! an engineering service of Washington Aluminum Company, Inc.

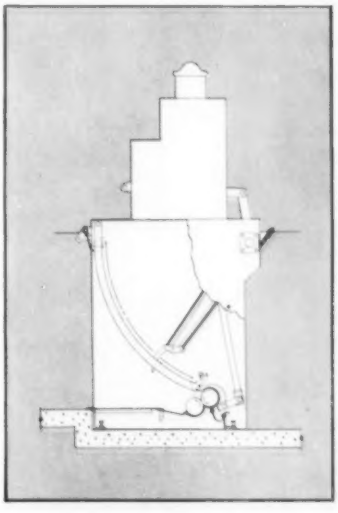
WASHINGTON ALUMINUM COMPANY, Inc.
Dept. 3710 • Baltimore 29, Md. • Phone Circle 2-1000



...for faster, more complete

COMMINUTION OF SEWAGE SOLIDS!

Most materials are handled in a single pass. Rollers at the bottom of a curved bar screen intercept heavy solids—lighter ones are raked down automatically. Any over-size comminuted solids are automatically re-screened and returned to the comminuting rollers until reduced to a size that permits passage through the screen.



No matter what the load may be, the unit operates continuously without harm to the mechanism, because of its rugged construction and safety devices incorporated in its design.

The "ROTOGRATOR" screen and comminutor is a completely packaged unit ready for simple and easy installation. A full range of sizes is available. For complete information write today for Bulletin 5150-A.

INFILCO

Over 60 years of engineering leadership in water, sewage and waste treating equipment.

Infilco Inc.
General Offices: Tucson, Arizona
P.O. Box 5033

Field offices throughout the United States and in foreign countries.

See it on display . . . Booths 68-69 F.S.I.W.A. Show . . . Oct 11 - 15

viding a hard surface for cleaning equipment.

Without cement treatment most sandy soils will have permeabilities higher than the maximum percolation rate allowable. The permeabilities of sands, loamy sands and the lighter sandy loams can generally be reduced to allowable limits with cement contents less than those required for soil-cement road paving. To reduce the permeability of coarse sands, cement contents comparable to those used in road paving may be required. Soils containing more silt and clay than those listed above (heavy sandy loams, loams, clay loams, clays, etc.) may not need treatment as the permeability is usually very low.

The amount of cement needed to reduce the permeability to the specified amount can easily be determined in the laboratory by running permeability tests on cement-soil mixtures covering a range of cement contents. The cement content that gives the specified permeability can then be chosen. In calculating the probable seepage loss, the type of soil underneath the lining, local hydrological conditions and other factors should be considered.

To reduce permeability the soil should be treated with cement for a minimum 5-in. compacted thickness.

Protection Against Wave Action

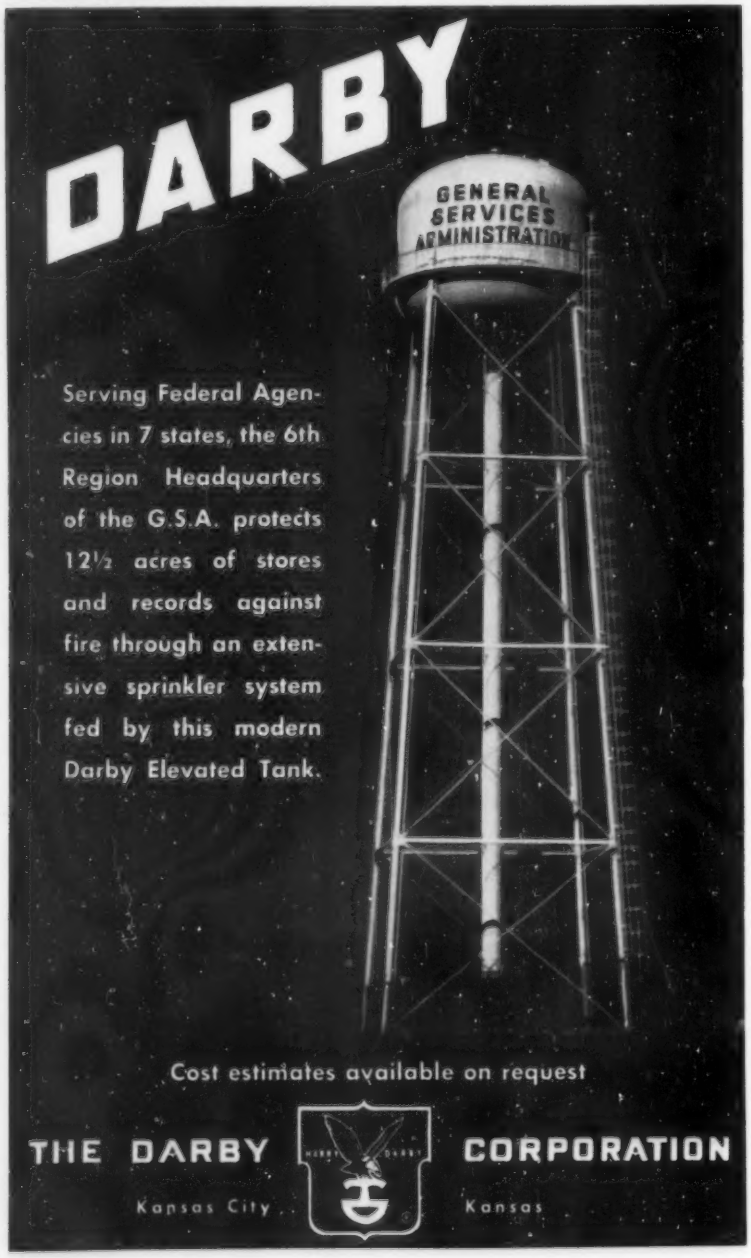
For the average reservoir or lagoon, a 6-in. thickness of hardened soil-cement will give adequate protection against wave action. Established ASTM-AASHO test methods are used to determine the proper amount of portland cement, the optimum moisture content and the density to which the mixture must be compacted. Short-cut test methods have been developed for use when sandy soils are being tested. Data from these tests indicate the amount of cement required to produce soil-cement which will meet criteria used for road paving. To obtain a lagoon or reservoir lining more resistant to water erosion and exposure, the cement requirement established by road paving criteria is increased two percentage points for soils containing less than 50 percent combined silt and clay. For soils containing 50 percent or more combined silt and clay, the cement content is increased 4 percentage points. For protection against wave action it is suggested that a strip be paved to extend from 5 ft. above to 5 ft. below the water line. This 10-ft. strip will provide a vertical freeboard of about 1 ft. when the slope of the embankment is 5 to 1.

Soil-cement linings are highly stable, which permits the use of heavy equipment for removal of accumulated sediment and debris from the bottom of the reservoir during cleaning operations. This would often be impossible on a soft surface.

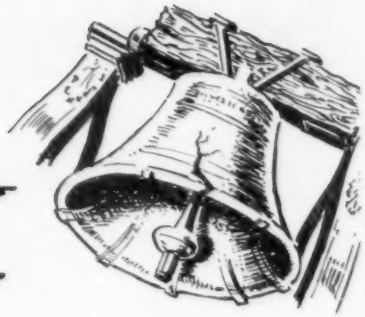
The bottom of the reservoir or lagoon can be paved with usual soil-cement road paving methods and equipment. To simplify construction procedures, it is suggested that the embankment and dikes be on a slope not steeper than about 4 to 1. Then the area can be paved using road paving methods by routing the equipment in a circular fashion. If it is necessary for the slopes to be steeper than about 4 to 1, they can be paved with soil-cement road paving equipment by using special procedures for routing the equipment up and down or along the slope.

Plastic soil-cement can also be used to advantage to pave slopes steeper than about 4 to 1 or areas too confined for ordinary road paving equipment.

This data appeared in the Soil-Cement News published by Portland Cement Association.


DARBY
GENERAL SERVICES ADMINISTRATION
Serving Federal Agencies in 7 states, the 6th Region Headquarters of the G.S.A. protects 12½ acres of stores and records against fire through an extensive sprinkler system fed by this modern Darby Elevated Tank.
Cost estimates available on request
THE DARBY CORPORATION
Kansas City, Kansas

PHILADELPHIA, PA. *



chooses

TYLOX

RUBBER PIPE GASKETS

TO

- ***PREVENT INFILTRATION***
- ***WHIP DETERIORATION***
- ***REDUCE PIPE-LAYING COSTS***

* **PROJECT:** TYLOX-coupled Storm-Sanitary sewer for city of Philadelphia, Pa.

ENGINEERS: Dept. of Water, Philadelphia, Pa.

CONTRACTOR: Globe Contracting Co., Upper Darby, Pa.

PIPE: 72" Concrete culvert pipe—United States Concrete Pipe Co., 12" Vitrified Clay Pipe—Universal Sewer Pipe Corp.

For its new combination storm-sanitary sewer shown here under construction, the city wanted long-lasting, low maintenance lines—built within the budget. Engineers wanted leak-proof lines that would **stay** leak-proof. Contractors wanted fast pipe jointing to help offset high construction costs. Here's how the choice of Tylox Rubber Gaskets helped meet all three requirements efficiently and economically:

1—TYLOX Gaskets have **seven** sealing ribs that "pack" pipe joints tight by compression. Natural resilience of the rubber **keeps** the seal watertight. Sewage treatment costs are reduced, and root and sediment problems are prevented.

2—TYLOX Gaskets speed pipe laying through fast assembly, and by eliminating trench work delays . . . mud and water can't slow up work, and laid line may be backfilled immediately. Installation costs are reduced.

3—TYLOX Gaskets are made of rubber specially compounded for immunity to sewage and industrial waste acids. Under ground and under compression, TYLOX outlasts the pipe itself.

Send for this brochure

It contains engineering data and shows typical TYLOX installations the world over. Read why TYLOX was specified, and take advantage of TYLOX on your next pipe project.

5087

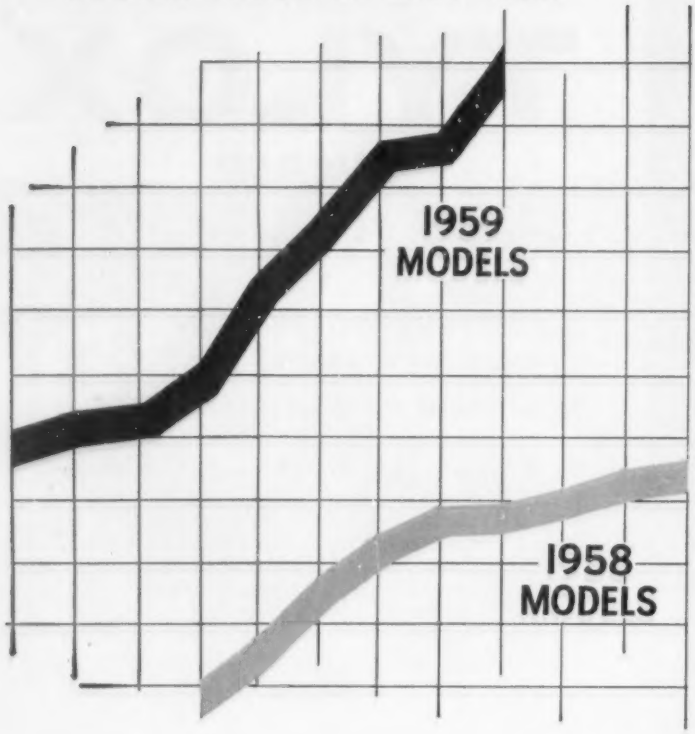
HAMILTON KENT MANUFACTURING COMPANY

KENT, OHIO

427 West Grant Street Orchard 3-9555

The BIG SUCCESS

1959 FORD SUPER DUTY TRUCK SALES MORE THAN DOUBLE THOSE OF LAST YEAR



1960 FORD SUPER DUTIES

SKYROCKETING SALES OFFER ADDED TESTIMONY TO THE TOUGHNESS AND RELIABILITY OF FORD "BIG V'S"— *NOW* THEY'RE MORE DURABLE, MORE FLEXIBLE THAN EVER!

Ford's increase in sales of Super Duty Trucks, while impressive in itself, by no means tells the whole story. Over half of the 1959 unit sales were the result of repeat orders from operators like Trucking Contractors, Inc., who bought because the Ford "Big V" provided the kind of performance and durability needed for their work.

And for 1960, the Ford Super Duties offer additional refinements designed to provide an even greater degree of dependability. Bigger optional axles and increased GVW's permit greater payloads and more profitable operation. Automatic radiator shutters to keep the engine temperatures within the most efficient operating range, submerged-type electric fuel pump to prevent vapor lock, and redesigned wiring for longer, more dependable operation are but a few of the improvements which add to the performance and durability of these units.

The changes offered for 1960 were tested and evaluated by America's foremost independent automotive research organization. The certified results of the studies by this impartial firm (name available on request) provide proof that Ford's Super Duty Trucks are even more dependable.

- **Certified Durability through closer temperature control!** Independent research engineers certify that Ford's thermostatically controlled radiator shutters kept water temperature between 168° and 188° in severe mountain grade operation. The test truck with shutters blocked open

of the Big Truck Field

"Tried 8 in '58—bought 20 more in 1959," says Curtis E. Brost, President, Trucking Contractors, Inc. "In 1958 we bought 8 Ford T-850's with lightweight chassis options and specially built 5-batch bodies which gave us a full extra batch per truck. A 5-batch load is a real strain on the truck when you consider we're 'running the ditches' on this highway paving job in North Dakota. These T-850's worked out so well that we ordered 20 more in '59. Our Ford Tandems with the 477 engine give us good mileage and the drivers are real happy with them. It's a rough go on trucks with soft footing and dust so bad we have to drive with headlights on. Despite such operating conditions, downtime has been negligible and these '477' Fords have given us less trouble than other trucks we have operated."

with Certified Durability

under same operating conditions had a temperature range from 102° to 181°. The temperature variation of only 20° with shutters means less expansion and contraction in engine block and cylinder heads. Higher temperatures with radiator shutters permit leaner fuel-air mixtures with less possibility of raw gas washing down cylinder walls. Warm oil circulates more freely, reducing internal friction. All these factors contribute to longer engine life.

- **Certified Dependability with longer-lived electrical system!** Ford's '60 improved wiring harness and the 1959 wiring harness were subjected to shaker table tests plus constant exposure to oil and water vapors and temperatures of 200°. Certified results prove that the greater resistance to deterioration by heat, oil, water and abrasion obtained with the 1960 wiring harness more than doubles wiring harness life.

- **Certified Reliability with Ford's submerged-type electric fuel pump!** Dynamometer tests of engines with submerged-type electric fuel pump and conventional mechanical type showed that vapor lock was non-existent with Ford's electric pumps at temperatures up to 200°, whereas incipient vapor lock with mechanical pump resulted in a power loss of 9% at an underhood temperature of 200°.

Test results like these plus the experience of satisfied users are important but that is not all. For 1960, the Super Duty line has been broadened to provide even more flexibility in power train options. Get the facts from your Ford Dealer!

FORD TRUCKS COST LESS

LESS TO OWN . . . LESS TO RUN . . . BUILT TO LAST LONGER, TOO!

THE HIGHWAY AND AIRPORT DIGEST

Prepared by **FRANK FORCE,** *Associate Editor*

Spring Patching After a Hard Winter

Outagamie County, Wisconsin, had their heaviest snowfall in recent years during the 1958–1959 season. However, it was a cold winter which kept thawing and freezing to a minimum, and the new asphalt patching mixers were able to push the spring work along at a record pace while obtaining quality repairs, and still keeping costs down. The county is a 20-mile square region of farm lands and has 316 miles of County Highways, 80 percent of which are bituminous, and 165 miles of state highways, county-maintained. The county highway department assigns this mileage to patrols each consisting of a patrolman, helper and truck. Eight patrols cover the state roads, each segment averaging about 23 miles, while the county roads are broken down into nine sections 30 to 35 miles in length. During the fall of 1958, the county prepared a supply of pre-mix materials to be used in patching work for the ensuing winter and spring. A large stockpile was composed of 3/8-in. chips with SC-3 asphalt, plus a smaller pile with ¼-in chips. During the patching season, the patrol trucks brought mix to the work site where it was heated and reworked before being laid. Two McConnaughay portable patching mixers are used to heat the material on the job.

"Spring Patching Was Easy For This County." *Roads and Streets,* August, 1959.

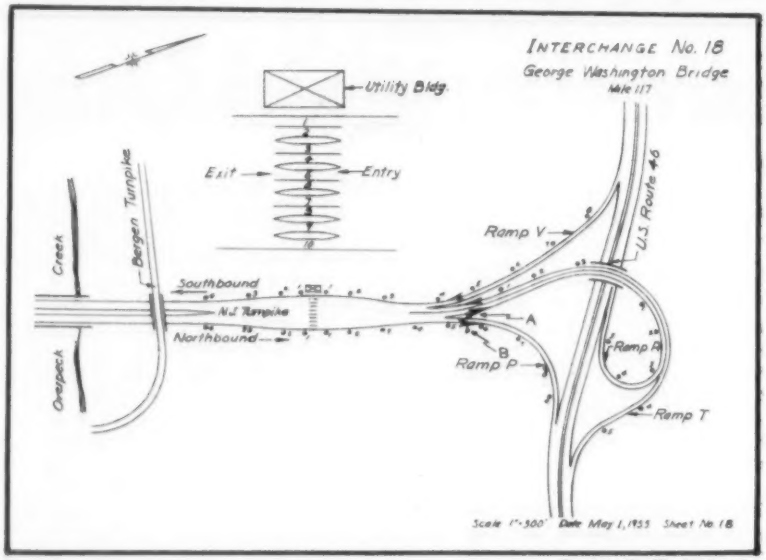
Overhead Signing

The George Washington Bridge Interchange is the northern terminal interchange of the New Jersey Turnpike system. The barrier toll plaza within the interchange area handles one of every four vehicles traveling the 131-mile Turnpike system. The lack of exit plaza capacity during peak periods in 1957 caused the Authority to advertise for bids during the spring of 1958 for the reconstruction of the plaza. Based upon traffic counts, it was determined that an addition to three toll lanes, bringing the total to 13 lanes, would be required to serve the traffic. The plaza widening resulted in a maximum exit plaza width of 180 ft. at the toll booths, funneling down to a minimum width of 96 ft. some 700 ft. north of the toll booths. The basic overhead sign layout selected at the plaza consisted of a 110-ft. long, 4½-ft. square cross-section, aluminum truss structure. It supported the two destinational signs. The signs were fabricated of porcelain on aluminum with white message copy and dark green background color. The sign bridge installation is built for a design wind loading of 100 mph. The sign truss provides a 17-ft. roadway clearance. In the case of a sign bridge installation, consideration should be given for provision of a man walkway along the base of the sign bridge. From this position maintenance of the sign face, fixtures, wiring and ballasts is possible without interference to traffic.

"A Case for Overhead Signing." By John R. Crosby, Traffic Engineer, New Jersey Turnpike Authority. *Traffic Engineering,* August, 1959.

Snow and Ice Control in Washington, D. C.

The snow program of Washington, D. C. Engineering Department comprises the plowing of snow from 342 miles of main thoroughfares and boulevards; the physical removal of snow from 33 miles of streets in the major business area; the progressive opening of crosswalks, catch basins and fire hydrants; and spreading abrasives and chemicals on the more important hills and intersections. The combined forces of the Sanitary Engineering Department



Courtesy Traffic Engineering

● **SCHEMATIC layout of original interchange at George Washington Bridge and N. J. Turnpike prior to plaza widening and addition of toll lanes and signing.**

Protect against accidents like this!

Use straight Morton Rock Salt—the most effective way to help keep streets, freeways and tollroads safer in winter

Straight Morton Rock Salt does the job abrasives and Salt mixed with abrasives can't do to help prevent accidents caused by ice and snow. Morton Rock Salt gives *abrasive traction* against skidding even before the salt starts to melt the ice. Rock Salt crystals are larger than other commonly used ice melting chemicals and *penetrate ice deeper* with a corkscrew action—not just melt surface ice. Due to Rock Salt's better penetration, it reaches the pavement fast and quickly *melts* the bond between ice and the street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand or cinders. What's more, Rock Salt melts *more ice at lower cost* at any temperature above 8° F. than any other commonly used ice melting chemical.

Send for more information today!

☐ Please send me your free book on ice and snow removal.

☐ I would like a Morton representative to advise me on how best to stockpile Morton Rock Salt.

Name_____

Title_____

Address_____

City_____ Zone____ State_____

MORTONSALT
COMPANY
INDUSTRIAL DIVISION

Dept. PW-10, 110 No. Wacker Drive, Chicago 6, Illinois

BANOX® KEEPS EVERY SCRATCH FROM LOOKING LIKE A SCAR

Rock salt is a fine controller of winter snow and ice. It saves traffic accidents. But its corrosive effect can cause minor scratches on automobiles to develop into ugly rusty scars. Motorists want protection against this unnecessary winter damage to their cars.

New formula BANOX controls this damage when added to rock salt. It effectively inhibits harmful salt brine corrosion.

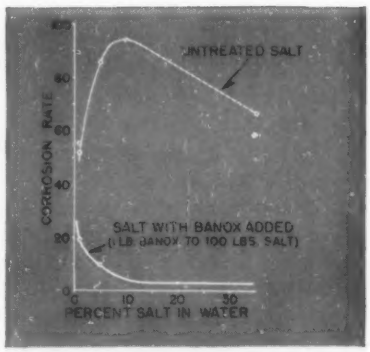
Remember these facts about new formula BANOX:

BANOX is effective: This is proved by the testimonials of scores of public officials and industrial leaders who have used it, as well as by extensive laboratory tests. The chart on this page illustrates how it sharply reduces corrosion.

BANOX is inexpensive: Only one pound is needed with each 100 pounds of salt. Although cost will vary with each city, it averages only a few cents per capita per year.

BANOX is easy to use: No special mixing is needed. Normal traffic movement distributes it evenly along roads and streets.

Find out more about safe, effective BANOX. Write for your copy of the BANOX booklet. Make winter driving in your city corrosion-free, complaint-free!



Laboratory tests show how BANOX added to salt reduces corrosion effectively in salt brines of any strength.

CALGON COMPANY
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

and the Highway Department are used on this work, supplemented by a considerable number of hired trucks. Expenditures under this program, depending on the severity of the winter, can vary from $200,000 to $600,000 or more annually, based on the limitation of available funds. The District's snow regulation contains four plans which may be put into effect by the Director of Vehicles and Traffic under certain conditions. The plans are: 1) Declaration that a state of traffic emergency exists because of snow and ice and operators of all vehicles which are not equipped with skid chains or snow-tread tires are subject to arrest; 2) request for the early dismissal of Federal and District employees; 3) issuance of a general warning to motorists that non-essential motor trips be cancelled; and 4) declaration of a parking emergency prohibiting parking on any of the 85 major arterial streets. Approximately 16,000 tons of sand were spread on the streets during the winter of 1957-1958. There are some 500 sand cans placed at strategic locations for voluntary use by motorists.

"Snow and Ice Control in the District of Columbia." By William A. Xanten, Supt., Div. of Sanitation, Washington, D. C. PUBLIC WORKS, September, 1959.

Bare Pavements in Milwaukee

Milwaukee's all-time annual average snowfall is only 46 in., but this total usually includes many falls of less than an inch. The city has no standby crews available for snow and ice control; therefore, such crews must be alerted from rubbish collection forces during working hours or men called from home at night. Eighty-two truck mounted salt spreaders are used on the 600 miles of streets that include the business section, arterials, bus lines, hills and arterial stops. In the 1958-59 winter season 20,000 tons of salt were used. Residential streets are salted only when a general ice or glaze condition develops. Usually about 20 "hill plows" are readied whenever a general ice control is on. If snow continues to fall and the "salt runs" have been completed once, a second shot may be ordered or the trucks may be brought in for plow blade mounting. This determination is only made following frequent contacts with the city's private weather service. Should the snowfall be of plowing proportions (3 in.) and occur mostly during the day, the salters and a token force

This Austin-Western power grader, property of City of Detroit, is cutting a precision grade in narrow, unpaved alley.

6 Austin-Western graders speed grading, sloping of Detroit alleys

Reverse grading is a difficult, unnatural and virtually impossible operation with most graders. But there are times when reverse grading is necessary... to maintain 300 miles of narrow, unpaved alleys, for example. Faced with this problem, the City of Detroit purchased six Austin-Western graders to do the job.

Precision grading in reverse

Jack Lezotte, Detroit Dept. of Public Works Maintenance Supervisor, says, "Grading and sloping narrow, dead-end alleys normally requires backing out at the end of each pass. But with the hydraulic controls, completely reversible blade, and rear-wheel steering, our A-Ws can grade in reverse. This means an extra pass forward and back-up is eliminated . . . cuts 50% off of time required to do the same job with other graders.

"I don't think you can beat the A-W. For close work, you can sideshift the blade back and forth hydraulically to clear obstructions in narrow alleys without losing forward motion. And for snow removal the blade sideshifts to pull snow right off sidewalks. It's tremendous.

Easy to operate and maintain

"Our operators like the A-W because it's easy to operate. And we like it because it saves dollars by doing a better job faster the year around . . . and our records show extremely low maintenance costs for the A-Ws."

There's a versatile Austin-Western grader designed to meet your needs. Available in 4 and 6-wheel models, all-wheel power and steering . . . front end power and rear steer, exclusive standard *plus* features. Contact your nearby Austin-Western distributor or write direct.

Austin 100th YEAR Western
CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.
BALDWIN · LIMA · HAMILTON
Power graders • Motor sweepers • Road rollers • Hydraulic cranes

Head sheave can be extended hydraulically . . . to set longer poles or to accurately spot transformers

Series PM-10

"Pole-Master"

HYDRAULIC DERRICK with "EARTH-MASTER" Hydraulic Digger

Handles the complete pole-setting job . . . in less time with less manpower

Out on the line, this derrick and digger combination digs a hole up to 20" in diameter, sets a pole up to 70' long—does the work so accurately, so effortlessly that it takes only three men to do the complete job in record time.

Every operation is fingertip controlled . . . fully-powered, positive and precise . . . with infinite spotting positions throughout an operating arc of more than 200 degrees.

Derrick is rated at 8,000 lbs. It body-loads, lowers to 18" above ground and furnishes more-than-ample down pressure for difficult digging work.

Standard sizes are available for handling 40', 55' and 70' poles. Addition of optional hydraulic head sheave extension substantially increases size of poles which can be handled.

Send for descriptive literature and prices.

Another reason why
UTILITIES EXPECT MORE FROM

POWERS American

UTILITY BODIES AND EQUIPMENT

McCABE-POWERS
BODY COMPANY

6900 NO. BROADWAY • ST. LOUIS 15, MO.

625 CEDAR ST., BERKELEY 10, CALIF.

5525 S.E. 25TH AVE., PORTLAND 2, ORE.

Series DF-1 "Earth-Master" Hydraulic Digger digs holes up to 20" in diameter, 10' in depth.

Guided-auger Series EM "Earth-Master" digs up to 30" in diameter and 10'6" in depth . . . vertically and at angles.

The LINE RIDER really mows 'em down!

THE LINE RIDER AND HIS GANG of Diamond Chemical killers can rid your roads of troublesome weeds and bushes. They'll do it quickly and save you money like they did out Ohio way, where they saved $18.75 per mile!

Meet the gang:

FOR MIXED BRUSH—LINE RIDER LV-3D/3T, a 2-Ethyl Hexyl Ester formulation of 2,4-D and 2,4,5-T containing 3 pounds each of acid equivalent per gallon.

FOR MAPLES AND OAKS—LINE RIDER LV-6T, a 2-Ethyl Hexyl Ester formulation of 2,4,5-T containing 6 pounds of acid equivalent per gallon.

FOR AREAS ADJACENT TO SENSITIVE CROPS—LINE RIDER AMINE 22, an alkyl amine salt formulation of 2,4-D and 2,4,5-T with 2 pounds each acid equivalent per gallon. Applied as a water-borne spray.

FOR SPECIAL CONDITIONS—Available are other standard LINE RIDER formulations, including Butyl and Low Volatile Esters of 2,4-D and 2,4,5-T containing 4 pounds acid equivalent per gallon.

If you want deadly marksmanship, send for new brochure giving details. Write Diamond Alkali Company, 300 Union Commerce Building, Cleveland 14, Ohio.

Diamond Chemicals

of plows continue operating on main streets through the evening rush hour, when all are brought in and their personnel released for a few hours rest. On a general plowing, all of the City's 1200 miles of streets are plowed. All-night parking is permitted on side streets throughout the year, with $4 per month police permits, on the odd numbered side on odd dates and on the even numbered side on even dates. In general plowing, 80 plows are used. Working in teams of two plows to a route, they report in when finished and are promptly re-dispatched to one of the 20 snow districts which are almost entirely residential areas. The plowing fleet consists of about 160 rubbish and garbage packers and 90 dump trucks, about half of the latter being heavy duty types. The total cost of snow and ice control last winter was about $1,200,000.

"Bare Pavements: Winter 'Must' in Milwaukee." By William J. Rheinfrank, Supt., Bureau of Street Sanitation, City of Milwaukee, Wisc. *Street Engineering*, August, 1959.

Maintenance of Roadside Slopes

In the last decade soil conservation has developed to a high degree. Effective methods are employed to hold soil on natural slopes and to keep such soil as close to ideal as possible. However, one should bear in mind that there is a world of difference between natural slopes, and the banks constructed by men and machinery. While natural slopes have a ready-made topography, grade and contour, man-made slopes are artificial. Their contour, grade, soil, even their future plant life are pre-arranged according to specifications. All this makes it obvious that bank construction is a comparatively new field where new ideas and bold theories are needed. The program presented in this article, based on conclusive experiments, involves: 1) Reorientation of sub-soil characteristics; 2) preparation of suitable top soil; 3) means of tying 1) and 2) firmly together; 4) better top drainage of banks; 5) selection of plants climatically best adapted to holding the soil in place; and 6) use of pre-grown plants, grasses and grass seed to give maximum holding power, in the least time and assuring minimum after-care. This program substitutes for expensive retaining walls, and supplies effective as well as aesthetic, cheaper and better methods of holding high and steep embankments, with reduced maintenance.

"Methods of Holding Roadside Slopes." By George Tukacs, The Berkshires Grass Co., Inc., New Milford, Conn. *Modern Highways*, July, 1959.

Patching Truck Becomes Multi-Use Machine

Patching costs have been cut by 60 percent in Garden Grove, Calif., by the use of a patching truck that is a multi-purpose machine. The street department launched a series of experiments on different types of oils and asphalt emulsions and equipment for patching. They decided to buy a 50-gal. fuel tank and a vapor hand torch. The tank was mounted on the side of a 1½-ton dump truck. A 25-ft. length of 1¼-in. liquid petroleum gas hose connects the tank and light weight torch, allowing coverage of a large area. To complete the equipping of the truck, a bitumen tank was mounted between the cab and body of the truck, together with an 80-psi air compressor. A self-propelled vibrating roller operates at 4,500 rpm and is equipped with carrying hooks for transportation on the tailgate of the patch truck. After drying out intersections with the torch and removing dead plant-mix material,

ARE YOU PROUD OF YOUR STREET NAME SIGNS?

Do your street-name signs reflect the pride of your community, and do they stand out so everyone can tell where they are? Uniform Miro-Flex Street-Name Assemblies can set you on the right track – and keep you there, even on a limited budget. There is a complete assortment of styles from which to choose, and all of them are embossed for long life – giving maximum strength, rigidity, and legibility. Send for your free copy of the Miro-Flex sign catalog and the name of your nearest source.

Embossed
MIRO-FLEX SIGNS ARE THE PRIDE OF ANY COMMUNITY...

THE MIRO-FLEX CO., INC.
1824 EAST SECOND WICHITA 7, KANSAS

Standard Traffic Signs Available for Immediate Delivery at Northeastern Warehouse
Koontz Equipment Corporation, 325 Ohio River Blvd., Emsworth, Pittsburgh 2, Pennsylvania

DOW | CALCIUM CHLORIDE

KEEP TRAFFIC MOVING...

with Dow Calcium Chloride

When ice and snow strike highways, be ready! **Supply traction fast** with direct application of Dow Calcium Chloride. Dowflake®, 77-80% flakes, or Peladow®, 94-97% pellets, melt snow and ice like hot buckshot . . . and keep traffic rolling safely on ice-free pavement.

Many engineers have found that Dow Calcium Chloride is the ideal mixer with rock salt or abrasives for all-temperature ice melting. Rock salt loses effectiveness at temperatures under 10°, while calcium chloride continues its quick melting action down to 59° below zero. Use of a 2 to 1 salt-calcium chloride mixture accelerates the action of the rock salt, thereby increasing its effectiveness at all temperatures.

Before the next snow or ice storm hits be sure you have a good supply of Peladow or Dowflake on hand. You may find it economical to order in bulk. For assistance on your specific winter problems by qualified highway engineers, or for literature pertaining to the handling, storing, mixing, and applying a winter maintenance mixture of calcium chloride and salt for ice control, contact THE DOW CHEMICAL COMPANY, Midland, Michigan.

For local assistance | Write THE DOW CHEMICAL COMPANY, CC401EC10, Midland, Michigan.

THE DOW CHEMICAL COMPANY · MIDLAND, MICHIGAN

RS-1 is applied as a tack coat. Then a bituminous surface material using 85/100 penetration asphalt is spread, luted, raked and rolled. An RS-1 emulsion seal coat is applied after compaction at about 0.15 gal. psy. To mop up any extra emulsion, Topeka top mix is broadcast over this oil and the spot is once again rolled. The torch on the truck can also be used for burning weeds along curbs, roadsides and drainage ditches. Another use of the torch is the burning of white traffic lines from the street pavement.

"Patching Truck Becomes Multi-Use Machine." By Seward Dart, Street Maintenance Supt., Garden Grove, Calif. *The American City*, August, 1959.

Municipal Parking— Operation and Design Standards

White Plains, the county seat of Westchester County, N. Y., established a Parking Authority in 1947, to provide adequate off-street parking facilities for both shoppers and commuters. The Authority has the following powers: To acquire land by purchase, lease or condemnation; to construct and operate off-street parking lots; to rent lots to concessionaires; to issue bonds up to a limit of $2,000,000; to pledge parking revenues for bond redemption; and to contract with the city for various services. At the present time the Authority operates 22 parking lots, with capacities ranging from 32 to 283 parking spaces, with a total of 4249 municipal parking spaces provided. The Bureau of Engineering of the Dept. of Public Works is responsible for the design and construction of all parking lots developed. Through the years a set of standards has been adopted by the Bureau which can be adapted to meet almost any conceivable condition or requirement. The following standards on lay-out have been adopted: Perpendicular parking, stall width 8.5 ft., stall length 18 ft. and aisle width 25 ft.; angular parking, stall width 8.5 ft., stall length 18 ft. and aisle width variable, depending upon angle; and parallel parking, stall width 7 ft. and stall length is 18 ft. with end access and 22 ft. without end access. The average cost for developing five of the most recent parking lots is $340 per parking stall. This total does not include either land costs or meter costs.

"Municipal Parking — Operation and Design Standards." By Carlton F. Hartman, Principal Engineer, Bureau of Engineering, White Plains, N. Y. Public Works, September, 1959.

Soil-Cement for Residential Streets

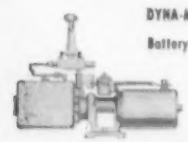
Every year since 1953 an average of five miles of streets has been paved with soil-cement in Sylacauga, Ala. The average width of streets is 26 ft., with the thoroughfares running up to 30 ft. Most of the work is done by contract, with municipal forces doing some of the minor work. The city owns all public utilities except telephones and before paving all utilities are connected to all vacant lots which eliminates tearing up the street after it has been paved. A typical paving program starts with grading, placing of concrete curb and gutter and construction of drive-way turnouts. Shaping is accomplished to final grade prior to placing cement. The soil classification varies, but 10 percent cement by volume is adequate. The roadbed with cement on top is then scarified to proper depth followed by thorough mixing. Sufficient water is added during the mixing operation for proper compaction. Standard curing is done with a cut-back emulsion to which the asphaltic wearing surface is added at any convenient time after seven

fast, dependable snow plow action

with MONARCH POWER

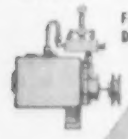
HYDRAULIC CONTROLS

Lift and lower the snow plow right from the cab . . . automatically . . . with Monarch Power Hydraulic Controls. Snow removal is easier, faster, more economical with Monarch. Instant up-and-down action with the flick of a wrist. See your dealer or write for illustrated folder.



DYNA-MIGHT
Battery-Operated

HY-LO-JACK HY-LO-JEEP



Fan-Belt Driven

MONARCH ROAD MACHINERY COMPANY
1331 Michigan St., N. E. — Grand Rapids 3, Michigan

BEWARE OF PIPE SHRINKAGE!

NPRC GUARANTEES COMPLETE RESTORATION OF CLOGGED WATER AND SEWER MAINS

Custom-built POWER equipment teamed with professionally trained crews make NPRC'S pipe cleaning unique. Through the vast experience of many jobs throughout the country, NPRC offers maximum results for ANY job, large or small . . . with peak efficiency and speed plus lowest costs . . . 100% money-back guarantee.

CONTACT . . . THEN CONTRACT . . . NPRC IS AMERICA'S LARGEST WATER MAIN AND SEWER CLEANING CONTRACTORS

For FREE facts, surveys & estimates on your problem, Call Collect, MOnroe 6-7700, Chicago, or write or wire.

NATIONAL POWER RODDING CORP.

General Offices:
1000 So. Western Ave. • Chicago 12, Ill.

WRITE FOR FREE CATALOG — THE STORY OF POWER

THE POINT OF NO RETURN...

HOW MANY WILL PASS IT ON YOUR HIGHWAYS TONIGHT?

A barely defined center line . . . the absence of a no passing stripe . . . and a motorist commits a fatal error of judgment. Unaware of the sharply dipping roadway and the oncoming car it conceals, he makes his move. In the next instant, the approaching auto is revealed . . . too late . . . he has passed the point of no return.

Properly laid pavement markings reflectorized with Cataphote Waterproof Reflective Traffic Beads can materially reduce nighttime traffic fatalities . . . in fair weather and foul. Many traffic engineers consider Cataphote Waterproof Beads one of their staunchest allies in a never-ending struggle to make streets and highways safer. And . . . a nationwide network of Cataphote Supply Centers assures them of prompt delivery . . . anytime . . . anywhere.

As long as there are roads to drive upon, drivers will err in judgment. Realizing this, the wise traffic engineer uses every means at his command to make existing highways safer. The man who fails to do so, commits the gravest error of all.

Cataphote
CORPORATION

TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

Manufacturers of CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS

Flink HDWS4 Completely Hydraulic Tailgate Spreader — A fleet of these efficient rigs help keep traffic rolling on the Illinois Tollway! Left-rear spinner permits easy 2-3 lane spreads in one pass; saves material. Hydraulically operated, Cab controlled, 2-speed auger permits instant change from abrasives to straight rock salt. Volume controlled by hydraulically operated feedgate.

Select

FLINK SPREADERS

When Specifications Require

- **ONE MAN OPERATION**
- **LOW MAINTENANCE**
- **LOWER COST**

Flink LMC Hopper Spreader — Handles salt, cinders and sand for heavy-duty ice control. Pea gravel and chips for seal coating. Choice of PTO, hydraulic or gasoline engine drive, Cab controlled. Uses the only power transmission of its kind in the field. No worm gears, no "out-of-straight" shafts of U-joints. Differential equalized drive.

Flink HD42 Hydraulic Drive Tailgate Spreader — Self-feeding. Handles sand, chips, cinders, calcium chloride, chat etc. Forward spread for ice control, reverses for seal coating. Spreads from width of truck to width of street, thick or thin. Replaces tailgate on present trucks. Trips for dumping just as original tail-gate did.

Flink Model SS Pull-Type Spreader —

Can't be beat for simple maintenance and operation. For low cost ice control, seal coating and dust control.

BAKER Flink SNOW PLOWS

FOR FAST, LOW COST SNOW REMOVAL!

Reversible or one-way plows for 1½ to 5 ton trucks and up. Sectional or one-piece, full length cutting edge trip. Exclusive blade-hinge weldments in place of hinges cut maintenance. Full 3¼" wear on a 6" cutting edge. Operating position adjustable 65° or 75° from horizontal.

For literature or name of nearest distributor, write:

THE Flink co. STREATOR, ILLINOIS

5513 North Vermillion Street

days. Typical cross-section consists of 6 in. of soil-cement base covered with a 1½-in. asphaltic wearing surface that overlaps the edge of the gutter. Approximate cost for the paving work is as follows: Soil-cement base, including mixing and water, 72¢ psy; preliminary shaping, 8¢ psy; and plant mix surface 150 lbs., 70¢ psy. Curb and gutter run about $1.60 per lineal ft.

"We Switched to Soil Cement." By Troy W. Smithwick, City Engineer, Sylacauga, Ala. *The American City*, August, 1959.

Aerial Inventory for County General Highway Maps

North Dakota's topography is particularly adaptable to the aerial method of road inventory. The flat and rolling terrain, the section-line road pattern, and the sparsely populated areas make it possible to identify quickly road and cultural features from the air. North Dakota, being the first State to institute aerial inventory operations, has in its initial 3 years produced better inventory data in much less time and at less cost than the conventional ground inventory method. Formerly, it was necessary for inventory crews to travel by automobile over every road and street in the State. The average inventory costs in 1958, based on the combined use of aerial and ground methods, amounted to approximately 27½ percent of the cost of the ground inventory method used in 1955.

"North Dakota's Use of Aerial Inventory for County General Highway Maps." By E. Thomas Bowen, Charles J. Crawford, North Dakota State Highway Dept., and John B. Kemp, Bureau of Public Roads. PUBLIC ROADS, August, 1959.

Other Articles

"Guides to Economical Design of **Highway Drainage.**" By R. Robinson Rowe, California Div. of Highways. Roads and Engineering Construction, July, 1959.

"**Safety Training** for Street Maintenance Personnel." By W. C. Wichman, Director of Public Works, Cincinnati, Ohio. Public Works, September, 1959.

"Winter or Summer . . . There's **Road Work for Graders.**" Holland, Mich. uses their motor grader on a year-round basis. By Laverne Serne, City Engineer, Holland, Mich. Public Works, September, 1959.

"Getting the Most from the **Consulting Engineer.**" How municipal officials can make more effective use of the services available from consulting engineers. By John R. Snell, Principal, Michigan Associates, Consulting Engi-

The greater your road mileage...

the wiser you are to use straight Sterling Rock Salt for ice control

One truckload of straight Sterling Rock Salt covers *eight* times more road mileage than a truck filled with abrasives alone. (It covers three to four times more road mileage than a truck of salt-and-abrasives!) Thus, with straight rock salt, reloading trips are drastically reduced, and your mileage is covered more quickly, more efficiently. In addition to the advantages of speed and economy, straight Sterling Rock Salt provides bare pavements—the only safe pavements during winter storms.

International Salt Co., Scranton, Pa. • Boston • Buffalo Charlotte • Chicago • Cincinnati • Cleveland • Detroit • Newark New York City • Philadelphia • Pittsburgh • St. Louis

STERLING "AUGER-ACTION" ROCK SALT

INTERNATIONAL SALT COMPANY, INC.

neers, Lansing, Mich. Public Works, September, 1959.

Baltimore's New Plan for **Winter Highway Maintenance.**" Reviewing snow and ice control methods and results under the city's revised plan for the 1958–1959 winter, and data from earlier winters. By G. V. Walters, General Supt. of Highways, and Snow and Ice Control Coordinator, City of Baltimore, Md. Street Engineering, August, 1959.

"**Salt is Still the Best.**" Rochester, N. Y. experimentally tries no-salt snow removal. By F. Dow Hamblin, Commissioner of Public Works, Rochester, N. Y. The American City, August, 1959.

"**Snow Removal** — Yankton Style." Small town uses versatility as a criterion to keep special equipment inventory at a minimum. By Robert L. Bartram, City Engineer, Yankton, S. Dakota. The American City, August, 1959.

"Calcium Chloride **Dust Control** on Unpaved Streets." Well planned program using city equipment saves money for Cherryville, N. C. By Tom Henry, Director of Public Works, Cherryville, North Carolina. Public Works, September, 1959.

"**Heater-Planer.**" A tool developed by the Texas Highway Department that utilizes a Caterpillar D-12 motor grader and a furnace for heating the asphaltic road surface. Also included are two self-sharpening cutting blades and an elevator that picks up the cuttings. Texas Highways, August, 1959.

"How Detroit Keeps **Streets Open in Winter.**" Five different combinations of action are taken, according to the type of storm and classification of streets. Salt is the "essential ingredient" along with quick plowing and loading where snowfall is heavy. By Glenn C. Richards, Commissioner of Public Works, Detroit, Mich. Street Engineering, August, 1959.

"Generalizing the **Vertical Curve.**" Simple method of drawing equal and unequal-legged vertical curves to fit any low-cost road or other situation. By Leonard B. Della-Moretta, Forest Engineer, U. S. Forest Service, Escanaba, Mich. Roads and Streets, August, 1959.

• • •

Pennsylvania to Use Radar for Traffic Counting

The Planning Division of the Pennsylvania Department of Highways has recommended replacement of electric eye detectors at their 55 permanent traffic counting stations. With low silhouette sports and conventional cars with increased glass areas, the electric eye detector has not produced the degree of accuracy required of automatic counting stations. To correct this condition, two other detection methods were tested.

Treadles, tested at 8 locations, appeared acceptable as to accuracy of count. However, because of truck traffic, reliable conversion factors of axle to vehicle counts could not be obtained..

A radar detector was tested, on both one traffic lane, in accordance with the manufacturer's recommendations, and in two lanes using a single radar unit; also the possibility of detecting only high vehicles by adjustment of the radar beam was tested. Results of the two-lane coverage of the high vehicle tests were not satisfactory, but the single lane installation proved accurate when checked against manual count. For a two-day period, 7 am to 6 pm, the radar accuracy was within 0.1 percent.

A factor of importance is the inconvenience to traffic during installation and servicing of traffic counting units. Radar installation requires lane blockage for only about 30 minutes.

Installation costs reported for a four-lane station, including recording counters, for the radar installation was $4,290.

RYNAL-SR

THE IDEAL STREET BROOM

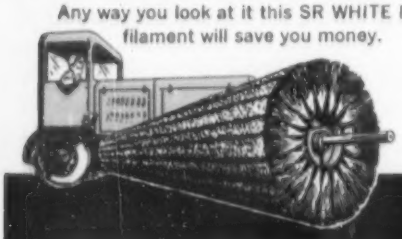
AVAILABLE IN YOUR CHOICE OF THREE PACKAGES

1 **PRE-FABRICATED,** filaments bound in steel for mounting in the RYNAL broom core.

2 **CUSTOM-COILED** on our automatic machinery for a precision product.

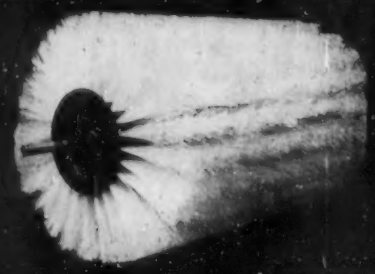
3 **BULK** for customer coiling.

Any way you look at it this SR WHITE broom filament will save you money.



RYNAL CORPORATION
114 ST. JOSEPH STREET
ARCADIA, CALIFORNIA

non-breakable, tough, long-wearing and low priced



MADE IN THE U. S. A.

GIVE US THE MAKE AND MODEL OF YOUR SWEEPERS AND LET US TELL YOU MORE ABOUT IT

ONE MAN...
your TRUCK DRIVER is your ENTIRE CREW

with these SEAMAN-ANDWALL

STĀ-BILT Century SPREADERS

• All STĀ-BILT Century SPREADERS* are operated hydraulically by finger-tip control in the truck cab. That's a big economy, for spreaders which require an additional man in the truck body (a dangerous position) to shovel bulk materials or to dump bags, cost at least $16 to $18 a day extra.

There's a STĀ-BILT Century model for virtually every spreading need — ice control, sealcoat work and for soil stabilization. Several units are multi-purpose so you have a longer period of productive, cost-saving work.

In addition to the STĀ-BILT Century Spreaders shown below, there is the SHY-34, a practical, low cost sealcoat unit which spreads a metered, clean margined mat 24 inches to 9 feet in width. Frequently the SHY-34 spreads chlorides in salt stabilization.

Then there's the Century HY-8, a low cost unit which is able to spread chlorides for ice control in extremely sparse amounts. It too, is popular in soil stabilization.

*Except the hopper type Century JUNIOR

The Century HY-4 is highly versatile. Equipped with a spinner the HY-4 spreads sand or chips from 24 inches to 40 feet for ice control.

In summer for sealcoat work, the spinner on the HY-4 can quickly be replaced by the channeled tray (above). With the tray the HY-4 spreads sand, stone, chlorides (for soil stabilization) and all types of aggregates up to 1½ inches.

Century Model HY-4LCT has the spinner and circular deflector mounted at the left hand corner of truck body. This allows truck to travel in proper traffic lane and spread on center line for dispersion of materials by traffic.

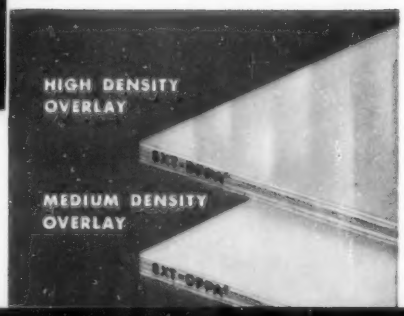
Would you like to learn more about all the STĀ-BILT Century Spreaders? We'll be glad to give you complete details.

SEAMAN-ANDWALL CORPORATION
A Subsidiary of American-Marietta Company
ELM GROVE 9, WISCONSIN

7078

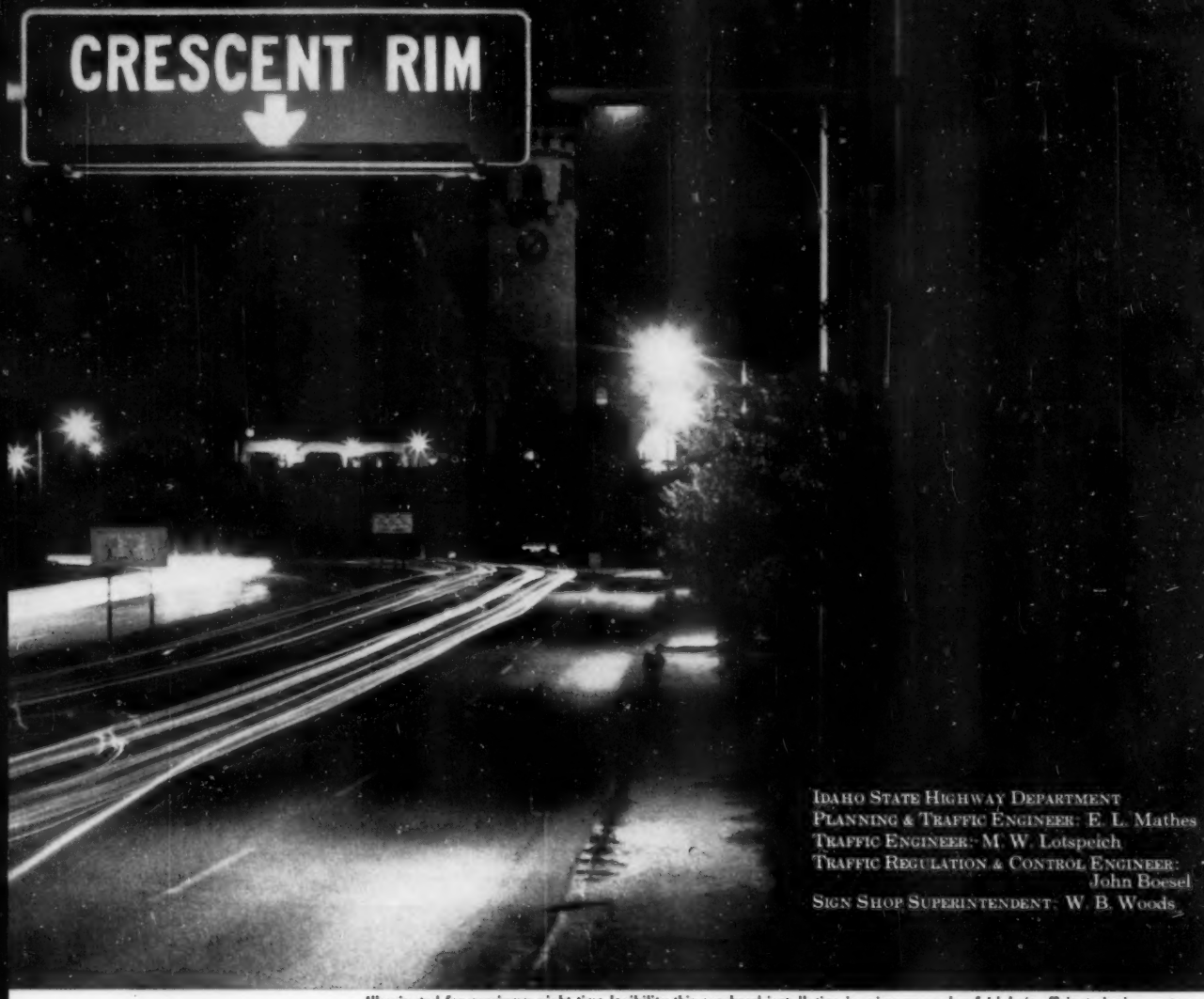
Idaho cuts maintenance with quality signs

On standard black-background informational signs, reflective letters are applied directly to black High Density overlaid plywood, eliminating painting.



High Density overlaid plywood needs no protective painting; color (black, brown or amber) is in the overlay. Medium Density is for plain painted signs. Base panel is waterproof Exterior plywood.

and replacement costs of overlaid fir plywood



IDAHO STATE HIGHWAY DEPARTMENT
PLANNING & TRAFFIC ENGINEER: E. L. Mathes
TRAFFIC ENGINEER: M. W. Lotspeich
TRAFFIC REGULATION & CONTROL ENGINEER: John Boesel
SIGN SHOP SUPERINTENDENT: W. B. Woods

Illuminated for maximum night-time legibility this overhead installation is prime example of Idaho's efficient signing system.

OVER 7,000 MODERN OVERLAID PLYWOOD SIGNS of every type and size help make motoring a pleasure on Idaho's scenic highways. They also help the state highway department do a better signing job at considerable savings to taxpayers.

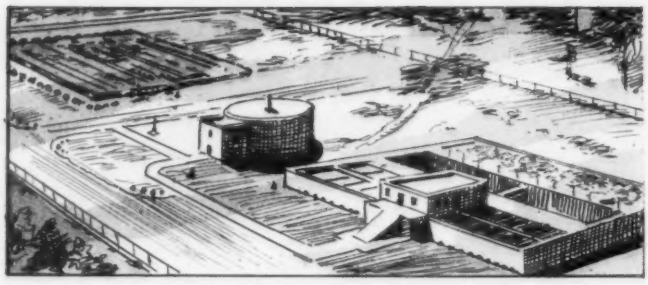
Until 1953, when Idaho switched to High Density overlaid plywood, maintenance and repair had been a constant problem. Weathering is unusually severe; temperature ranges from 115° above to 40° below zero. Vandalism damage from hunters in isolated areas and resultant progressive deterioration were particularly troublesome. Under these rugged conditions, overlaid plywood has performed consistently well—particularly in areas where signs are subjected to unusual abuse. As a result, maintenance costs have dropped sharply.

Initial fabrication and installation costs are also less. Records at the Idaho sign shop in Boise show a completed overlaid plywood sign costs between 10 and 15 percent less than aluminum.

DOUGLAS FIR PLYWOOD ASSOCIATION
TACOMA 2, WASHINGTON
—a non-profit industry organization devoted to research, promotion and quality control

DFPA TESTED QUALITY

THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

ABS and Treatment Processes

In recent years increasing amounts of surface active agents, especially alkyl benzene sulfonate (ABS), have found their way into sewage and has caused concern among sewage treatment personnel as to whether present or foreseeable concentrations would interfere with sewage treatment processes. This paper represents a progress report on some aspects of research growing out of the mutual interest of sanitary engineers and producers of surfactants in the fate of ABS in wastewaters. The principal objective of the investigation was to employ such analytical methods and techniques as experiments demonstrated to be appropriate and to determine the ability of sewage treatment processes to remove or destroy detergents as well as the ability of detergents to interfere with such processes. Results of these and related experiments led to a number of conclusions. 1) No evidence was found in the investigation to indicate that the concentrations of ABS found in domestic sewage threaten to render the sedimentation, activated sludge, or filtration units of a treatment plant incapable of performing the functions for which they are designed. 2) Sedimentation is not an effective process for removing ABS from sewage. 3) In prolonged experiments during which the BOD removal was 88 to 97 per cent, ABS removals varied from 19 to 77 percent. 4) Greater average ABS reductions are generally achieved with high solids concentrations in the mixed liquor than with normal or low concentrations. 5) A single-stage activated sludge unit under 4 to 6-hr. aeration should consistently remove 50 to 60 percent of the influent ABS. 6) The trickling filter did not compare with activated sludge in efficiency of ABS removal. 7) Intermediate or tertiary treatment of sewage can be used to remove 80 to 90 percent of the ABS in sewage. 8) A continuous process of stripping ABS from sewage effluents by induced frothing and burning of froth with waste digester gas appears to be a feasible and highly efficient method of ABS removal.

"Removal of ABS by Sewage Treatment." By P. H. McGauhey and S. A. Klein. *Sewage and Industrial Wastes*, August, 1959.

How To Kill Psychoda

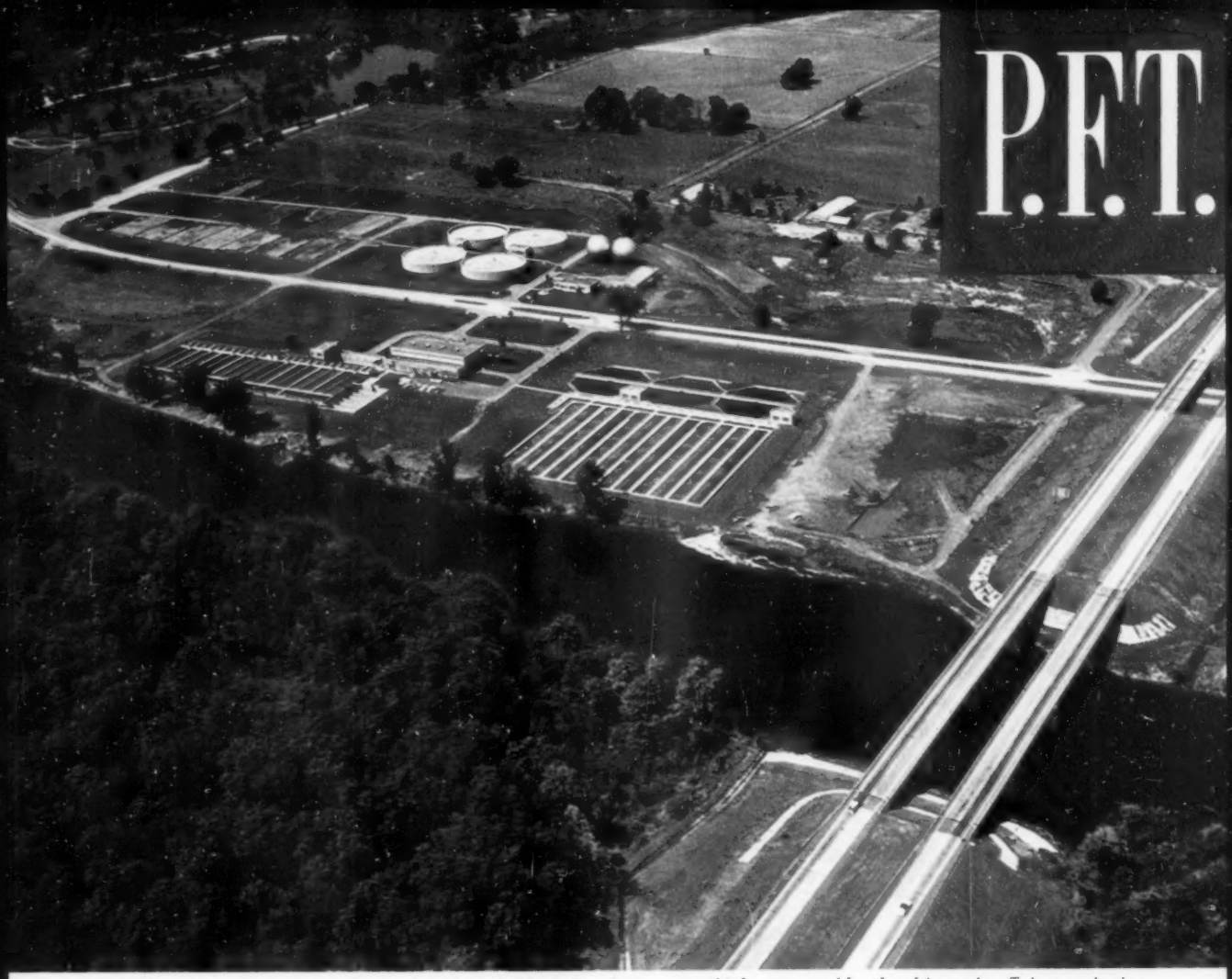
When the psychoda fly population in the trickling filters at the Southwest Utilities Corp. sewage treatment plant at Houston, Texas, developed a resistance to DDT and lindane insecticides a new method of treatment was found necessary to get rid of the infestation that was unbearable to plant personnel and nearby residents. In September, 1958, treatment was started with a new type of insecticide formulation for psychoda control known as "R.S.C." which contained DDT as a chief insecticidal ingredient, in combination with other chemicals which decreased psychoda resistance to DDT. Each filter bed was dosed with from 2 to 3 gallons of this formulation three times at four to five-day intervals in order to achieve effective control during the emergence of the various stages in the 12 to 14-day life cycle of the psychoda fly. The results have proved that this treatment was very successful in reduction of the larval and adult populations. BOD determinations showed that the presence of RSC in the filter beds had no adverse effect on BOD reductions.

"How to Kill Psychoda." By G.N. Free. *Wastes Engineering*, August, 1959.

Mechanical Aeration Methods

Interest in mechanical or surface aeration for activated sludge has been renewed as a result of the publication over the last few years of the record of the successful operation of full scale units of this type at the Manchester Sewage Treatment Works. Because of this interest, the author undertook the

● **SANITARY landfill at Farmville, Va. This 13-acre lot receives 27 cu. yards of packed refuse and 20 to 25 yards of loose material daily. The IHC Drott Four-in-one compacts the dumped refuse and spreads a 4-in. earth cover at end of the day.**



South Bend's new sewage treatment plant, bounded by Indiana's new superhighways, provides the ultimate in efficient sanitation.

A parallel in progress . . .

Sewage treatment at South Bend keeps pace with the superhighway era

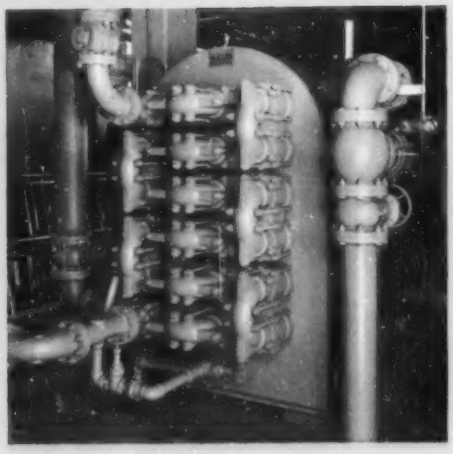
In an era of superhighways and rapid economic growth, South Bend, Indiana, stands among the country's leaders. The city has accomplished much to make the whole South Bend area attactive to industry and new residents.

This new sewage treatment plant has eliminated a long-time health nuisance for South Bend and all the communities to the north on the St. Joseph River. Recreational facilities have been created and the river restored to its natural beauty.

Industry has cooperated in this "clean-up" campaign and South Bend has made many friends up and down the St. Joseph. Modern P.F.T. sewage treatment equipment has played a vital role in making this all possible. South Bend is truly a better place to live for its present residents and for the many who will reside there in the years to come. For further technical information on the South Bend Story please turn this page.

P.F.T.

Consulting Engineers—Consoer, Townsend and Associates, Chicago.



Special P.F.T.-Drum Type Heat Exchanger Units.

The four 110′ P.F.T. floating covers at South Bend

And these are only a part of the P.F.T. equipment used in South Bend's new Sewage Treatment Plant. The heat for the digesters is supplied by two P.F.T. No. 750 Heaters and Heat Exchangers and two P.F.T. No. 429-E Special Drum Type Heat Exchanger Units (shown above).

These Special Drum Type Heat Exchanger Units are so arranged that 3,600,000 B.T.U. of engine jacket water heat may be transferred to the sludge circulated to the digesters with excess heat dissipated to effulent circulated through the drum shell. The P.F.T.-Kraus Process for Activated Sludge Control is also used in South Bend.

Sound engineering, modern equipment and progressive city planning put South Bend among the leaders in cities seeking sound economic growth in our rapidly expanding economy.

Waste Treatment Equipment
Exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

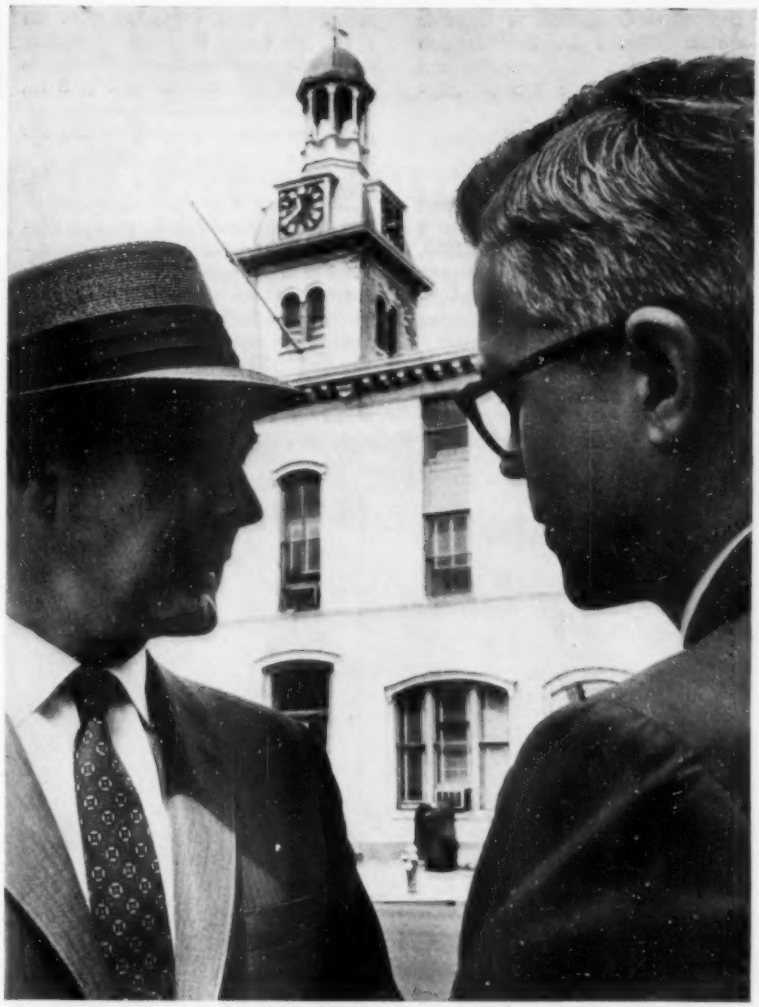
PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

study of the relative economies of aeration methods used for activated sludge. On the basis of this study it is the author's contention that both theory and fact strongly support the claims of the proponents of surface aeration, namely, low cost construction, low cost of operation and substantial freedom from maintenance difficulties, and that surface aeration should be given serious consideration in the design of sewage treatment plants. Several tables and photographs add considerably to the value of this interesting and timely article.

"Relative Economy of Activated Sludge Aeration Methods." By W.E. Howland. *Water & Sewage Works*, August, 1959.

Stabilization Ponds

The stabilization pond or basin is an impoundment with a controlled depth, usually of regular geometric shape, where biological growth is encouraged for the purpose of consuming contaminants as food. It is not an alternate to the trickling filter or the activated sludge process where the removal or reduction of organic chemicals in the plant effluent is required by biological treatment. The most significant factor in whether a stabilization basin is a feasible alternate or not is land cost. Some disadvantages associated with operating stabilization ponds are 1) the release of a considerable volume of water in the case of a break in the dike wall, 2) seepage of polluted waters into the ground water in areas with permeable soils, 3) insect breeding, particularly mosquitoes, and 4) possibility of taste and odors in the oxidation pond effluents from the algae and other micro-organisms which develop in the pond. None of these problems has proved so serious that they were beyond solution. Other factors that must be considered in addition to those previously mentioned in selecting oxidation ponds for biological waste treatment are the weather conditions which influence loading rates and therefore treatment costs. The amount of sunlight and the number of days of sub-freezing weather greatly influence the efficiency of this process. Light penetration is also a significant variable in operation. The normal depth for stabilization ponds appears to be 4 or 5 ft. although shallower and greater depths have been used. Generally it would appear that a stabilization basin designed on the basis of a loading of 50 lb. BOD/day per acre of surface will be satisfactory.



"If you're thinking about a Municipal Trust or Fiscal Agency talk to the people at Chase Manhattan"

New York's leading bank has the men and the experience you need to handle Municipal Trust details at high-level efficiency.

* * *

Any municipal or governmental unit considering a bond issue will find it profitable to talk to the people at Chase Manhattan.

Chase Manhattan's Trust Department is staffed with people long experienced in every detail of acting as Municipal Trustee and Fiscal Agent. Their experience and technical skill enable them to serve you efficiently and administer any agreement, no matter how complicated.

The range of Chase Manhattan trusteeship runs from the nation's biggest toll roads to its most expansive utilities. Chase Manhattan municipal trust customers extend to every corner of the free world.

If you are an officer of a municipality or a governmental unit, talk to the people at Chase Manhattan about your trusteeships. The address is 40 Wall Street, New York 15. The telephone number—HAnover 2-6000.

THE CHASE MANHATTAN BANK

Member Federal Deposit Insurance Corporation

"Biological Oxidation of Organic Chemical Wastes In Stabilization Ponds." By Wm. M. Steinfeldt and J. T. Garrett. PUBLIC WORKS, September, 1959.

Edmonton's Activated Sludge Plant

Edmonton, Alberta, the most northerly city of its size with a population of 267,000 persons in 1958, has the largest complete treatment plant in Canada. Edmonton is located on the North Saskatchewan River which has wide variations, the maximum being 204,500 cfs and the minimum 220 cfs as shown from records of flow compiled over 30 years. Minimum flows occur during the winter months when ice cover is present in thicknesses of 2 to 3 ft., and under these conditions the replenishment of oxygen from the atmosphere is negligible. During the summer months the river is capable of absorbing a great deal of pollution due to the high flows and dissolved oxygen content. Consequently, the requirements for a high degree of treatment during the winter months only are contrary to conditions encountered in warmer climates. The sewage treatment plant was designed on the basis of DO and coliform limits based on surveys of the North Saskatchewan River by the Alberta Provincial Department of Health. The plant was designed in such a way that it can conveniently be operated as step aeration, conventional activated sludge, and other modifications. The plant consists of aerated grit tanks, comminutors, rectangular primary settling tanks, digestion tanks for either single or two-stage operation, aeration tanks using diffuser nozzles, and rectangular final settling tanks. Sludge collectors in both the preliminary and final tanks are arranged for grease removal. Lagoons are provided for the storage and disposal of digested sludge. Several photographs, charts, and graphs accompany this article.

"Activated Sludge Treatment At Edmonton, Alberta." By Norman G. McDonald. *Sewage and Industrial Wastes*, August, 1959.

Mill Creek Sewage Works

The Mill Creek Sewage Treatment Works dedicated in June, 1959, is the main treatment plant serving the metropolitan Cincinnati area. It has a number of interesting features including the use of closed-circuit television on the raw sewage bar rack. The plant is of the primary settling type, augmented by preaeration and provision for the occasional use of coagulants. Provision is also made for use of chlorine for odor control and disinfection. Processing of sludge includes digestion, elutriation of the digested sludge, chemical conditioning and dewatering by vacuum filters, and alternative incineration or drying of the filter cake. Sewage gas provides all the power required in the operation of the treatment works. The author also provides a brief discussion of the personnel training program in order to have an efficient operating organization.

"Cincinnati-Mill Creek Sewage Works." By A. D. Caster and A. M. Mock. *Civil Engineering*, August, 1959.

Other Articles

"Experiments on the **Dissolved Oxygen Requirements** of Cold-Water Fishes." The influence of temperature on the minimum oxygen concentrations and other factors were studied under controlled conditions. By R. C. Davison, W. P. Breese, C. E. Warren, and P. Doudoroff. Sewage and Industrial Wastes, August, 1959.

"Allocating Wastes Treatment Costs To Industrial Department Operations." This manuscript dealing with the relationships of engineering and economics was judged as one of the best written

The SeweRodeR Opens Clogged Sewers *Faster!*

The "Automatic" SeweRodeR affords the most economical known way of opening sewer stoppages *faster* — RAIN OR SHINE.

- Flooded manholes are no problem. All set-ups and operations are from street level. A safety hose guides the rods into the sewer.
- It rods more footage in one run — up to 900 feet NON-STOP — due to its greater rod holding capacity.
- It rods more footage daily due to its super-speed and special safety control features which prevent damage to rods and machine.
- Under *average* conditions operator and helper can rod up to 4,000 ft. daily at a cost under 3c per foot.

THE ONLY RODDING MACHINE WITH POSITIVE, NON-SLIP ROD DRIVE

Let our representative give you the complete facts — or write for our 8 page SeweRodeR folder.

FLEXIBLE INC.

3786 DURANGO AVE., LOS ANGELES 34, CALIF.
1005 SPENCERVILLE ROAD, LIMA, OHIO
415 S. ZANGS BLVD., DALLAS, TEXAS

How consulting engineers save money for clients on sewage treatment for communities in need

How often have you had the frustrating problem of trying to figure out how a client's residential development can fit into an area where sewage facilities are already at capacity. More septic tanks are out of the question. Sewage lagoons aren't the answer, either. Yet, clients don't often have the money for a multi-million-dollar central system. And then . . .

One day you see this ad in Public Works Magazine. The headline holds promise, so you read on. You find there *is* a conventional sewage treatment plant your client can afford—NOW. Its name is "Suburbia." It handles populations of 250 to more than 2,500 . . . can be installed in 90 days or less . . . involves less initial and operating capital than any other type of plant.

You're gratified to discover that the supplier works only through consulting engineers, assumes undivided responsibility for the entire plant, and is glad to provide you with complete shop drawings. This means your client will get a sewage treatment plant designed specifically for his needs. The best professional practices will be maintained. The unit will satisfy State Department of Health requirements.

Simplicity of the plant pleases you, for unskilled help can operate it. The only moving parts are a free-swinging rotary distributor and a small humus pump. Starting as Imhoff/trickling-filter/final, "Suburbia" can be expanded to a mechanical plant for greater capacity. You are assured that, with minimum maintenance, the unit produces no objectionable odor or bacteria-laden foam.

Considering all facts in the light of your professional experience, you're interested. You decide to investigate further. Your secretary poises her pencil, then takes a letter to . . .

MUNICIPAL SERVICE COMPANY

4625 Roanoke Parkway • Kansas City 12, Missouri

TYPICAL NORTHERN INSTALLATION goes below-grade to take advantage of residual ground-warmth during colder winters. This one serves 58 homes (20,100 gallons per day) at the Nike-Hercules Base, Lonejack, Missouri. Other installations range as far north as Michigan.

TYPICAL SOUTHERN-STATES INSTALLATION can go above-ground. Costs drop when tanks need not be buried, true of most of the South. This installation serves 118 homes (41,600 gallons per day) in the Debra Heights Development, St. Petersburg, Florida.

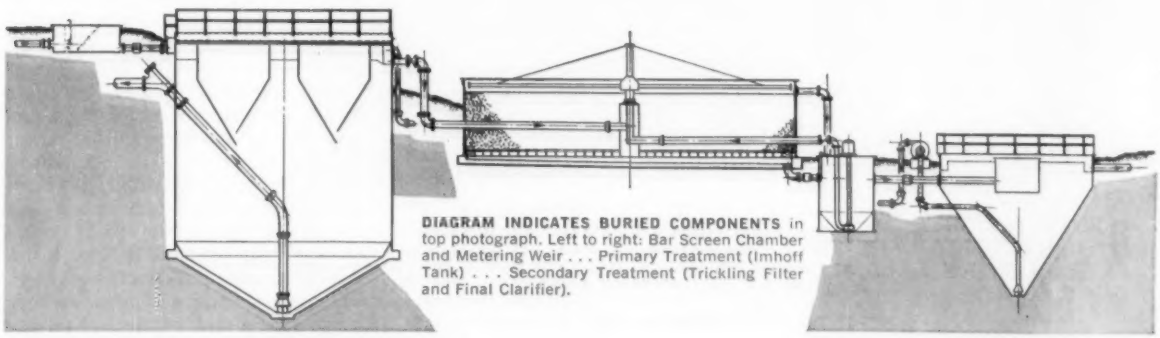


DIAGRAM INDICATES BURIED COMPONENTS in top photograph. Left to right: Bar Screen Chamber and Metering Weir . . . Primary Treatment (Imhoff Tank) . . . Secondary Treatment (Trickling Filter and Final Clarifier).

Turn Your Meter Reading
inside-OUT!
with
ViSi METER
ViSi-Meter
Accurate within .01%
Requires minimum up-keep
Protected with Tamper proof seals
Remote registry for
WATER OR GAS METERS
AT LAST a practical remote indicator and recording system. Tested and approved. Now used by 43 cities. ViSi-Meter eliminates city expense and liability of controlling keys to customers' residences. Easily read in one trip by meter readers.

Customers like ViSi-Meter because no one need enter the home to read the meter.

THIS PRODUCT IS MANUFACTURED AND GUARANTEED BY
ViSi-METER, Inc.
301 NORTH 17th STREET, KANSAS CITY, KANSAS

What you should know about

SOIL ENGINEERING

SOIL engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition, or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs to assist the engineer in his work.

ORDER from Book Department, PUBLIC WORKS, 200 So. Broad St., Ridgewood, N.J. Only $1.00 per copy.

this year at the Indianapolis meeting of the National Association of Accountants. By R. H. L. Howe and K. W. Coers. Wastes Engineering, August, 1959.

"What Makes **Fish** Live—and Die." A discussion of those environmental conditions, as well as physical, chemical and physiological conditions, which influence the ability of fish to extract oxygen from the water in order to survive. By C. M. Tarzwell. Wastes Engineering, August, 1959.

"Sinusoidal Variations in **Dissolved Oxygen**." Oxygen content of New York Harbor waters is predicted from sampling studies and interpretations of extrapolated sine curves. By T. R. Glenn, Jr. and G. T. Cowherd, Jr. Wastes Engineering, August, 1959.

"A Modern Look At **Refuse Incineration**." This article takes a modern look at incineration and pinpoints its present trends in design and operation. By LeRoy W. Van Kleeck. Public Works, September, 1959.

• • •

Sludge Gas Utilization

(*Continued from page* 117)

flash dryer in which hot gas passes through the cage and carries the dried sludge to a cyclone separator. In both cases, the heat of the gas is utilized efficiently by countercurrent flow.

Incineration is generally accomplished by feeding sludge cake (either raw or digested) from a vacuum filter onto the top hearth of a multiple-hearth incinerator, from which the cake is moved down a series of hearths by rakes. The sludge cake is gradually dried by preheated air (700-900 deg. F.), ignites, is burned, and the ash cooled and removed. Sludge gas can be used as a source of fuel for these operations (3). Raw sludge can often be burned without supplementary fuel, and activated and digested sludges may sometimes be so incinerated, provided a low-moisture cake can be achieved.

Rotary dryers are made by Standard Steel Corp., Hardinge Co., General American Transportation Co., Link-Belt Co., and Arnold Dryer Co. Flash dryers are made by Combustion Engineering, Inc. Multiple-hearth furnaces are made by Nichols Engineering and Research Corp., Morse-Boulger Co., and Combustion Engineering, Inc.

Control Instruments

In designing facilities for the collection and utilization of sludge gas, our first concern is the protection of life and property. Our next concern should be provision for continuity of operation, and our third should be economic considerations. It should be understood that this is not to mean that little or no consideration should be given to treatment plant costs, but that every reasonable and practical safeguard should be incorporated into plant design which will assist in achieving our primary objectives—safety and continuity. Instruments are vital in carrying out all of these objectives.

Since manpower is such a large part of the cost of plant operation today, the centralization of both controls and instruments is taken for granted in most medium size and larger plants. Transmitting operational data to one central panel enables one responsible operator to keep up with all important phases of plant operation and to direct subsidiary employees in the performance of operational functions. The old axiom that you can't run a job from the seat of your pants is as true as ever however, and instruments of lesser importance should be located at the site of the primary signal and shift workers required to make regular rounds and record instrument readings—in most cases, once every hour. It is tempting to over-design plant instrumentation under the guise of "automation," but it is well to consider that many instruments and/or telemetering combinations are costly, and that expert maintenance will be required. So, once again, each situation will require careful study and appraisal.

All devices which sound alarms when conditions are abnormal should have the alarm signal located where it can be heard inside, especially in noisy engine rooms. Panel board systems are available in multi-station units (such as made by Panalarm Div. of The Panellit Co.) to which the signal is transmitted and both an audible alarm and a flashing light are activated, the lamp showing the location of the trouble by illuminating a translucent panel on which the name of the particular function is lettered. The operator pushes a button which silences the alarm, but the light remains burning until the malfunction is corrected. High or low pressures and temperatures, high and low levels, outside source power failure, shutdown of equipment, presence of a combustible gas mixture, overflow, and instrument failure (zero indication) are examples of functions commonly monitored. As far as practical, equipment such as engines, boilers, sludge heaters, compressors and positive displace-

RELOCATED TOWNS START RIGHT WITH D-O EQUIPPED SEWAGE PLANTS

Modern installations provided for three communities moved by St. Lawrence Seaway project

Relocation of three Ontario communities, made necessary by construction of dams for the St. Lawrence Seaway, has brought one important benefit – the opportunity to build new and modern sewage treatment plants. In each case, basic equipment was manufactured and supplied by our Canadian Associate, Dorr-Oliver-Long Ltd.

D-O is a foremost supplier of sewage and water treatment equipment to meet the needs of any type of plant, regardless of size, kind of treatment desired or the local conditions involved. For details on the wide range of units available, write to Dorr-Oliver Incorporated, Stamford, Connecticut.

IROQUOIS, ONT. Equipment supplied: Clarifier, 30' dia. x 12' SWD; Digester, 25' dia. x 18' SWD; Sludge Pump. Design population: 5,000. Design flow to plant: 600,000 GPD.

Consultants: Proctor & Redfern, Toronto, Ontario.

MORRISBURG, ONT. Equipment supplied: 2 Clarifiers, primary type, 20' square x 7' SWD. Design population: 5,000. Design flow: average 600,000 GPD, maximum 900,000 GPD.

Consultants: James F. MacLaren & Associates, Toronto, Ontario.

LONG SAULT, ONT. Equipment supplied: 2 Clarifiers, primary and secondary, each 28' dia. x 8' 6" SWD. Design population: 3,000. Design flow: average 360,000 GPD, maximum 605,000 GPD.

Consultants: Marshall, Macklin & Monaghan, Don Mills, Ontario.

DORR-OLIVER

WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT

ment pumps should be equipped with trip-out relays, or other type of automatic shutdown, so that neither personnel nor equipment will be endangered. Each case must be judged on its own merits. Few would doubt the wisdom of providing automatic shutdown activated by high-bearing temperature on a large 3600 rpm centrifugal blower, for example.

Process instrumentation is an enormously and endlessly complicated matter, and once again the advice of the specialist is often needed. It is my belief that the instrument companies are anxious to be of sincere and practical service, particularly if contacted on administrative levels, for they are fully aware of the folly of overselling.

The human element is an important factor in instrumentation. The engineer's client must understand the need and benefits of sound instrumentation. The operator must realize that while it is true that a recording of a given function may be a "fingerprint" of the manner in which his responsibility has been carried out, it is also a means of doing a better job, and proof that he has done so. All this should be carefully explained, for the cooperation of the operator is absolutely necessary; it is quite simple for him to sabotage an installation and gain the sympathy of uninformed management. Many instrument companies offer service contracts, which are well worth while if the customer does not have trained personnel. It must be made clear that instruments are delicate precision tools, and should be adjusted or repaired only by trained personnel. Several instrument manufacturers offer intensive training courses for both mechanics and engineers at very nominal cost, for they have been quick to realize the problems set forth here.

Manufacturers of instruments applicable to the development of sludge gas utilization are too numerous and familiar to be mentioned, but such companies as The Foxboro Company; Industrial Div., Minneapolis-Honeywell Regulator Co., Burgess-Manning Co., B-I-F Industries, Bailey Meter Co., Fischer and Porter, Bristol Co., Simplex Valve and Meter Co. are specialists in this field. For complete information, refer to the SEWERAGE MANUAL.

Analytical Instruments

There are two classes of instruments used for the determination of sludge gas quality: 1) Instruments for chemical analysis, which may be either continuous or batch-basis types and 2) instruments for the determination of physical characteristics.

Instruments of the first class range from simple industrial devices for field use, such as the Mine Safety Appliances Co. hydrogen sulfide detector, a small rubber bulb pipette with absorption cell which is sensitive enough to detect from 0 to 50 parts per million H_2S, to very complicated and precise laboratory instruments. The Burrell Premier Model is capable of analyzing any mixture of gases, and is manufactured, together with a large number of less complex instruments by the Burrell Corp. Burrell also offers a manual on gas analysis (12).

We are actually largely concerned with the methane content of sludge gas because the Btu content is in direct ratio to the amount of methane. However, the determination of methane requires more complicated equipment and analysis than does the determination of carbon dioxide, and since the other constituents of sludge gas are minor, apparatus for the determination of carbon dioxide is all that is needed for most practical purposes. Further, the determi-

When it comes to your bucket jobs come to O'Brien!
See the all-power Sewerking® BUCKET MACHINE for 1960!
READY NOW—the revolutionary Bucket Cleaner that completely removes sand, big roots and other heavy sewer obstructions as never before! Built extra heavy, strong and safe—important automatic features for easy operation—greater power, pull and capacity to clean more sewer at lower cost!
ASK FOR INFORMATION ON THE NEW SEWERKING BUCKET DUMPER
O'BRIEN SEWERKING
WRITE, WIRE OR PHONE TODAY FOR FULL INFORMATION —without obligation!
AVAILABLE IN 9-16-25 HP.
NATIONWIDE SALES AND SERVICE
PHONE ROdney 3-7433
O'Brien MANUFACTURING CORPORATION
Dept. PW 1059 • 5632 Northwest Highway, Chicago 46, Illinois

Continued Success

ORDERS for the Coilfilter continue to come in for United States and Canadian application. We are presently rounding out a program of shop and office expansion which will help strengthen our position in the Sanitary Field.

Since 1954, we have been studying the basic phenomena involved in Fresh Solids Dewatering, and approximately 50 successful Coilfilter installations have been made utilizing this Process. Our conservative approach has paid off; not only has effective equipment been developed for accomplishing this Process, but we have also learned what pitfalls exist and must be avoided.

The writer traveled to England and Scotland in order to personally check the technical aspects of sludge dewatering and make comparisons with our American practices. As a result of the investigation, a licensing arrangement has been made permitting application of our Coilfilters in countries outside of North America, especially in connection with Fresh Solids Dewatering.

There appears to be a substantial market for our equipment in Canada, and we have therefore purchased a site in Brampton, Ontario, and propose to build a shop and office at this location.

Experimental work on other phases of Sanitary Engineering is continuing, and we hope to be of service to the Field for many years to come.

Respectfully,
T. R. Komline

KOMLINE-SANDERSON
ENGINEERING CORPORATION
MANUFACTURERS OF THE COILFILTER
PEAPACK, NEW JERSEY

nation of carbon dioxide may be made by operating personnel without requiring the services of a chemist. The principal requirements are a good sample and fresh reagent. Since carbon dioxide measurement is simple, frequent checks on the gas from each digester should be made because the gas is the most representative sample of the digester and rising carbon dioxide content can be the first warning of impending acid (sour) conditions and malfunction of the digestion process. Also, as carbon dioxide increases, our Btu content drops.

Larger laboratories should be equipped with Orsat-type apparatus for complete analysis of sludge gas; most models can be fitted with a case for portability. Costs range from $150 to $300. In addition to the Burrell Co., Arthur H. Thomas Co., Fisher Scientific Co., Central Scientific Co., Harshaw Scientific Div., and other laboratory supply houses furnish a variety of Orsat apparatus.

Continuous analysis of gas streams may be provided if desired. There are two serious pitfalls in this case, however: 1) The gas is wet and must be dried and 2) the gas is dirty — containing suspensions of considerable quantities of what is apparently colloidal carbon and/or carbon compounds. Therefore, it is necessary to install dryers and filters (felt will not suffice) ahead of the analyzer.

Two continuous gas analyzers are offered: 1) The Foxboro-Liston-Becker Infrared Gas Analysis system is sold by the Foxboro Co. and 2) the M-S-A Lira Infrared Analyzer, sold by Mine Safety Appliances Co. What is believed to be the first installation of an infrared analyzer is located at the Winston-Salem, North Carolina, waste treatment plant, Piatt and Davis, Consultants, Durham, North Carolina.

In addition to infrared analyzers, continuous analysis of sludge gas may prove practical and less expensive by means of in-process gas chromatography (13). Such instruments are now being used in the chemical process industry and are very promising.

As to the second class of instruments for the determination of physical characteristics, we are concerned only with the Btu content. The Junker-type "Precision" automatic-gas calorimeter has been adopted as standard for check tests by the U. S. National Bureau of Standards and is sold by laboratory supply houses for about $600. This apparatus demands skilled technique and considerable care and patience to get reproducible results. If trained personnel are not available, commercial laboratories may be called on. Members of the mechanical engineering staff on the faculties of engineering colleges and technical institutes will often be glad to make Btu determinations. In most cases, however, simple checks on the carbon dioxide content of the gas and the performance of equipment such as engines, will tell us what we need to know concerning the quality of the gas.

Safety

Although so much has been written on this subject that I hesitate to say more, I would not want anyone to assume that the matter is not of the utmost importance (14). The engineer must be safety minded as well as the operator, and provide all reasonable safeguards in his plant. There are legal considerations also. For example, in a case involving J. Doe vs. City, damages were sought for injury resulting from a fall into a tank unprotected by guard rails. The issue was decided by an affirmative answer by the jury to this question: "Is it usual and customary to provide railings around such tanks?" Of course common sense must prevail in such cases, for if a rail were provided around everything from which injury might occur, it would be impossible to operate the facility.

Since many deaths have occurred from an accumulation of gas in a

Electronic Surveying for Sewer Plan

THE FIRST USE of a new electronic surveying instrument for sewerage improvements has been reported by an aerial mapping company, which used the technique to complete mapping for a big construction project in a fraction of the time traditional methods would have required.

Officials of Allegheny County, Pennsylvania, called upon Aerial Map Service Company of Pittsburgh to map the entire Borough of White Oak as a first step in developing a long-range public works program. The most immediate need was for new sewer lines and a treatment plant. The borough wants to lay 90,000 feet of sewer pipe during the next three years (at a cost of $900,000) and to construct a major treatment plant.

A contour map to the scale of 50 feet to the inch with 2-foot intervals was required. Aerial Map Service Company was directed to run a series of triangulation and traverse controls throughout the area to give first-order accuracy to the maps and for the later use of public works engineers. Such high-order control points would be used repeatedly in the future, officials reasoned, for highway work and other projects.

The Pittsburgh firm brought in a Tellurometer System, a new electronic distance-measuring device, to help establish horizontal controls. The radar-like instrument, working off Coast and Geodetic Survey stations, produced accuracies of 1 part in 137,000—far in excess of the specifications.

The greatest advantage realized, however, was the speed by which the operation was completed over terrain which was very rugged. Part of the assignment required establishing points along the Monongahela River where steep banks could have slowed survey parties to a crawl.

With the Tellurometer, surveyors set a transmitter on one point and

a receiver on the other. Impulses are beamed from one unit to the other and the instrument determines the time it takes the microwaves to travel the distance. This time, in billionths of seconds, is easily converted into miles, feet and inches.

Exclusive FLUiD-TITE Coupling joins lengths of varying crushing strengths and sizes. Assemble in any weather—without heavy machinery.

K&M ASBESTOS-CEMENT SEWER PIPE

Infiltration-proof at 25 psi pressure!

Exclusive, patented "K&M" FLUID-TITE Coupling maintains a permanently infiltration-proof seal under severest field conditions.

This is true even when "K&M" Asbestos-Cement "FLUID-TITE" Sewer Pipe is under deflection, or is buried at various depths under heavy backfill. Tests prove this infiltration-proof pipe can withstand 25 psi external water pressure.

There's minimum maintenance with "K&M" Asbestos-Cement FLUID-TITE Sewer Pipe. It reduces treatment loads and costs. Requires fewer periodic inspections and cleanings.

Eliminate the problem of infiltration with tested and proven "K&M" Asbestos-Cement FLUID-TITE Sewer Pipe. Write to us today.

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
COMPANY • AMBLER • PENNSYLVANIA

sump, basement, or other subground level installation, forced draft fans of ample capacity with a source of outside air ought to be provided.

A point often overlooked is that many plants encourage visitors, and while plant personnel may be well trained as to good safety practices, the visitor must be protected. Warning signs should be posted where needed; they should be easily read and permanent in nature. Visitors should always be accompanied, and forbidden entry without permission. Finally, the engineer can render great service by insisting on a good safety-training program in the plants he designs, and management is more disposed to listen to him than to their own employees—after all, they are paying for his services.

Conclusion

At the beginning of this article, I have stated the premise that continuity of effective treatment is today the most important consideration involved in deciding whether to utilize sludge gas; I believe that within reasonable limits and with due regard for the ability of the client to pay for such facilities, no responsible engineer will take issue with me. I also wish to repeat that neither by insinuation nor direct statement do I intend to leave the impression that economic factors are to be taken lightly—they are as important as ever, and I am very conscious of this fact as the operator of three waste treatment plants, one hydro plant, and one water purification plant!

I am indebted, and am happy to acknowledge my debt to the following people who assisted me in the preparation of this article: Prof. Ernest Elsevier, Dept. Mech. Eng., Duke University, Durham, N. C.; Prof. George C. Harwell, English Dept., Head, Engineering English, College of Engineering, Duke University, Durham, N. C.; William M. Piatt, III, Partner, Piatt and Davis, Consulting Engineers, Durham, N. C,. and J. S. Welch, Chief Operator, Northside Plant, Water and Sewer Dept., City of Durham, N. C.

References

1. Wisely, W. H., and Symons, George E., *Sewage Works Journal Index, vols. 1-20, 1928-1948. The Garrard Press*, Champaign, Ill., 1950.
2. Bloodgood, Don E., et. al., *Municipal Sewer Ordinances*, Federation of Sewage and Industrial Wastes Associations, Washington, D. C., 1949.
3. Fair, Gordon M., and Geyer, John C., *Water Supply and Waste Water Disposal*, pp. 764-5, 769-71, 780, 786, John Wiley and Sons, Inc., 1954.
4. Bartsch, Alfred F., and Ingram, William M., "Stream Life and the Pollution Environment," PUBLIC WORKS, Vol. 90, No. 7, July, 1959, p. 106, Fig. 4.
5. Hardenbergh, W. A., "Sewerage and Sewage Treatment," Third Ed. pp. 384-5, 388, International Textbook Co., Scranton, Pa., 1950.
6. King, G. R., et. al., *Purging Principles and Practice*, American Gas Association, New York, N. Y., 1954.
7. Upper Mississippi River Board of Public Health Engineers and Great Lakes Board of Public Health Engineers, "Standards for Sewage Works." — O. J. Muegge, Chief Engineer, Wisconsin State Dept. of Health, Madison 1, Wis., 1952.
8. Johnson, A. J., and Auth, G. H., *Fuels and Combustion Handbook*, McGraw Hill, New York, N. Y., 1951.
9. Obert, E. F., *International Combustion Engines*, Second Ed., International Textbook Co., Scranton, Pa., 1958.
10. Eshbach, O. W., *Handbook of Engineering Fundamentals—Power*, Second Ed., John Wiley and Sons, New York, N. Y., 1952.
11. Elsevier, Ernest, Prof. Mech. Eng., College of Engineering, Duke University, Durham, N. C., Personal Communication to Author.
12. *Burrell Manual for Gas Analysts*, 7th Ed., Burrell Corp., 2223 Fifth Ave., Pittsburgh 19, Pa.
13. Escher, E. E., "In-Process Gas Chromatography," *Chemical Engineering*, Vol. 66, No. 15, July 27, 1959. p. 113.
14. Van Kleeck, L. W., "Safety in Sewage Treatment Plant Operation," PUBLIC WORKS, Vol. 90, No. 6, June, 1959, p. 121.

TENNANT MODEL 100 is available with cab, power steering, flashing lights, rotating beacon, etc.

Now . . . a new way to sweep up ALL the dirt

You've never seen such clean sweeping as you'll get with the TENNANT Model 100 Vacuumized Sweeper.

Powerful pickup. Cleaning a 7'4" path, this remarkable new sweeper gets virtually *all* the dirt. Particles fine as 5 microns (far smaller than human eye can see) are caught by the huge 540 sq. ft. filter.

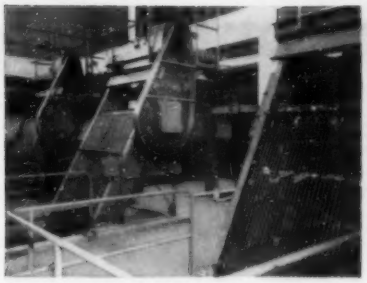
No dust, no water. Since the Model 100's powerful brush-and-vacuum system captures the dust, there's no need for water spray . . . therefore no unsightly mud streaks, no winter freeze-up problem.

Many uses. Short (10'2") turning radius and ultra-clean sweeping makes the TENNANT 100 ideal for downtown areas, alleys, parking lots, tunnels, bridges, air terminals, better residential areas . . . wherever you want *really clean sweeping!*

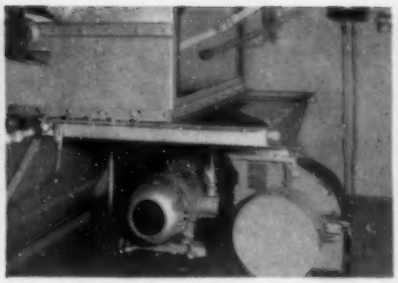
WRITE TODAY *for complete specifications and performance data. G. H. Tennant Company, 755L N. Lilac Drive, Minneapolis 22, Minnesota.*

TENNANT

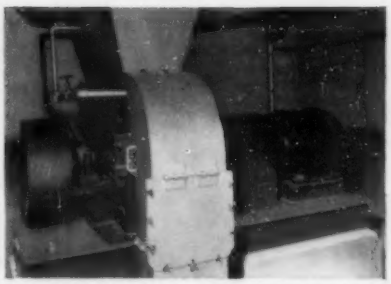
VACUUMIZED SWEEPERS



Bar Screens—*mechanically back-cleaned units eliminate jamming at the bottom of screens.*

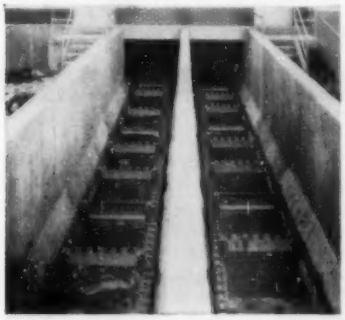


Screenings Grinders—*dispose of sewage screenings without increasing scum on primary tanks.*

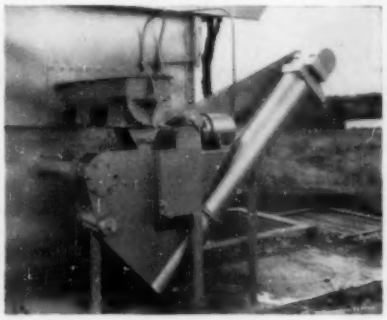


Garbage Grinders—*make it practical to dispose of garbage through sewage treatment plant.*

Grit Collectors—*Scraper, elevator, V-bucket types . . . all gather, wash and elevate grit.*



Grit Washers—*remove more than 90% of putrescible solids . . . make grit suitable for fill, walkways.*



Floctrol® Process—*provides complete flocculation in shortest possible time and with minimum chemical dosage.*

Here's why JEFFREY is *right* on the job

. . . in hundreds of small and big volume plants

SIMPLICITY characterizes Jeffrey sewage treatment equipment, because it means low operating and maintenance costs.

DESIGN INGENUITY AND QUALITY CONSTRUCTION are part of each Jeffrey product because they are essential to efficient, trouble free, long lived performance.

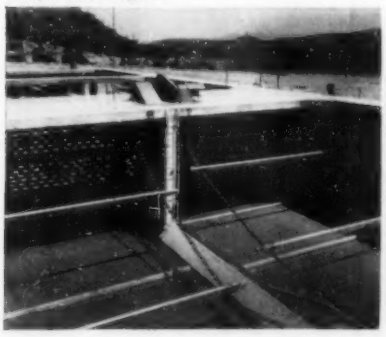
Nothing can be taken from . . . or added to . . . Jeffrey design specifications without sacrificing efficiency, operating convenience, economy or lasting qualities.

Jeffrey engineers apply this standard of perfection to everything we make . . . from the SUPERMAL chain on a sludge collector, to rates of agitation in our patented FLOCTROL process. The Jeffrey Manufacturing Company, 947 North Fourth St., Columbus 16, Ohio.

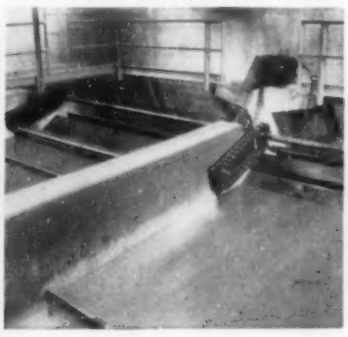
CONVEYING • PROCESSING • MINING EQUIPMENT . . .
TRANSMISSION MACHINERY . . . CONTRACT MANUFACTURING

JEFFREY

Sludge Collectors—*large carrying capacity permits intermittent operation . . . power savings, thicker sludge, clearer effluent.*



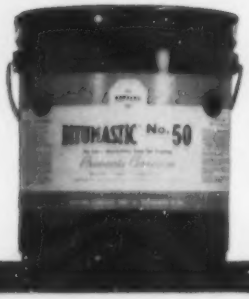
Scum Removers—*power-driven where accumulation requires almost continuous removal . . . rotating pipe type for occasional removal.*



Primary and Final Settling Tanks—*stable conditions of flow provide maximum solids removal in tanks of minimum size.*

Build your corrosion-

Bitumastic Super-Service Black—excellent heavy-bodied protection for structurals, tanks, equipment, and concrete, too.



Bitumastic No. 50—the thickest protective coating you can buy—and thickness spells long-life in tough service!

Bitumastic Hi-Heat Gray—all the name implies: a special zinc-base coating for stacks, boilers, other hot spots.

Bitumastic Black Solution—a paint-like general maintenance coating *but* with coal tar's unique protective ability.

Bituplastic No. 28—almost equal in body to No. 50, and an excellent weather-resistant coating.

Bitumastic Tank Solution—for potable water tanks and the like . . . imparts no taste or odor.

prevention program around

BITUMASTIC COATINGS

Experienced Service
—almost as important as our fine product, you'll get it from our specialists on corrosion.

Bitugloss Aluminum
—used alone, or as a decorative top-coat for Bituplastic No. 28, this coating has amazing gloss-retention.

As with most engineering problems, there's no one, pat answer to all corrosive conditions: that's why Koppers designed the *line* of coatings under the Bitumastic® label. Covering a broad range of cost and protective ability, it is likely that the *one* best solution to your corrosion problem can be found among the coatings in the Bitumastic line.

The common denominator to the protective ability of Bitumastic coatings is coal tar: nature's own "wonder material" that has unique resistance to oxidation and water penetration, common causes of coating system failures. The magical properties of coal tar make a story in themselves, however, and we'll be glad to send you a booklet that describes them more fully.

In fact, if you're not familiar with Bitumastic protective coatings, we'll be glad to send any or all of the literature noted below. Or perhaps you'd like to review your problem with a Koppers representative or an experienced Bitumastic distributor. Just indicate your choice on the coupon below. No obligation, of course.

KOPPERS®

BITUMASTIC
REG. U. S. PAT. OFF.

another fine product of COAL TAR

Koppers Company, Inc.
Tar Products Division, Department 138K
Pittsburgh 19, Pa.

Send me the information circled at right on corrosion prevention:

Name _____

Title _____

Firm _____

City _____ Zone ____ State ____

That story on coal tar

Bitumastic #50

Bituplastic #28

Bitumastic Super-Service Black

Bitumastic Black Solution

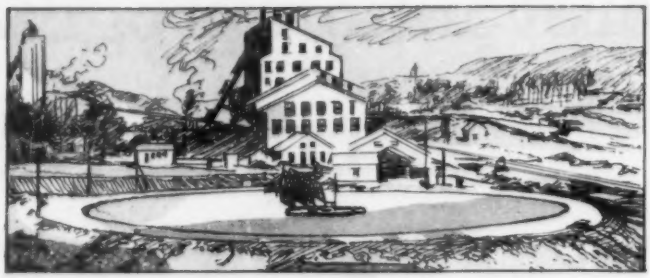
Bitumastic Tank Solution

Bitumastic Hi-Heat Gray

Bitugloss Aluminum

I'd like to discuss my corrosion problem with your man

THE
INDUSTRIAL WASTE DIGEST



Prepared by **CLAYTON H. BILLINGS,** *Associate Editor*

Metal-bearing Acid Wastes

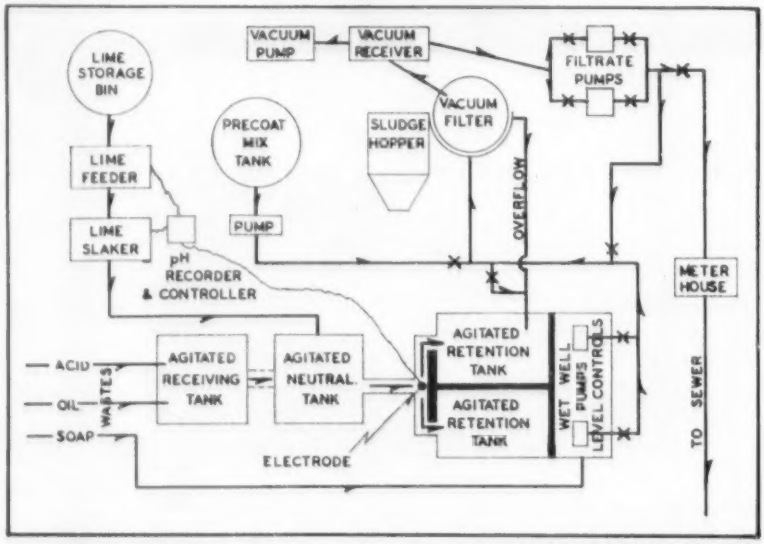
At the Conneaut Base Plant of the General Electric Co., the manufactured products are incandescent and photoflash bulbs, automobile headlights and fluorescent lamp bases. Following adoption of a city ordinance limiting the character of the waste discharge, it was necessary to employ measures for treatment of the industry's bright-dip acid wastes and discharged soluble oils. Plant housekeeping measures were instituted and processes were changed to reduce the waste load. Pilot plant studies were undertaken which showed that mixing the oil wastes and acid effluents could break the oil emulsion. The waste treatment plant eventually designed involves a continuous flow process in which the acid and oil wastes are piped directly to an agitated receiving tank where mixing occurs. The mixture is treated with a lime slurry in a second agitated tank with automatic pH control. The treated wastes then flow into a retention tank for a 1½ to 2-hour mixing period. Final treatment is by a vacuum filter after being mixed with the soap wastes. The lime slurry is prepared by a slaker using a 4 to 1 water lime ratio. The filter is a precoat drum-type with a variable speed automatic advance knife blade. The retention tanks are provided with walking beam flocculation equipment. The installation cost was $276,000, 44 percent of which was attributed to the building housing the equipment. The highest equipment expenditure was $30,000 or 10.9 percent for the filter. Operating costs amount to $3,793 per million gallons of treated waste, 24.1 percent of which is the cost of filtration. It is estimated that the pilot plant work preceding the design saved more than $24,000.

"Design and Treatment of Metal Processing Wastewaters." By O. V. Nyquist and H. R. Carroll. *Sewage and Industrial Wastes,* August, 1959.

Evaluation of Spray Irrigation Design Factors

To determine the effectiveness of disposal of dairy plant wastes by spray irrigations at selected sites in Wisconsin, a project was undertaken which included soils and engineering aspects of the problem. Six sites were selected with data obtained on milk intake, cheese production, character of water supply, and character and size of irrigation system. The average milk intake varied from 10,600 to 33,500 lbs. per day, with waste volume averages of 380 to 5,900 gpd. Application rates were 0.13 to 2.3 in. per hour. It was found that volumetric and cation loading were the most significant design factors, with BOD data of much less significance than in biological treatment systems. Reasonable predictions of irrigation rates possible at a given site can be made from information on soil, groundwater and crop conditions, but final design application rates can best be determined by observance of the crop actually under irrigation. The waste-holding tank volume should be small in summer to minimize odor development. Irrigation throughout the winter is mechanically possible in central Wisconsin, but only with complete kill of the cover crop, because of ice formation. With hot wastes, damage to cover crop may be avoided by elevating the spray nozzles. Where a soil with poor absorption characteristics is encountered, the use of tile drainage systems several feet below the surface have been found effective. In cold climates, serious consideration should be given to alternate methods of disposal during the winter months.

"Spray Irrigation of Dairy



Courtesy Sewage & Industrial Wastes

● **FLOW diagram for treating waste waters containing metal-bearing acid wastes.**

Well worth your reading! This authoritative article that confirms effectiveness of Cloroben in grease and odor control:

(as published in August 1958 issue of *Wastes Engineering*)

solving

OPERATING HEADACHES

Sewage Odors Corrected by Chemical Treatment

By **WILLIAM H. WECHTER, P.E.**

Diplomate American Academy of Sanitary Engineers

Chief Sanitary Engineer
1st Army Engineers

At one installation which provides only primary settling of sewage prior to discharge of the effluent into the receiving waters, Cloroben is used both for odor control and to keep sewer lines grease-free. It has been particularly important to keep this facility odor-free because the primary settling tanks of the plant are in close proximity to homes.

The sewage plant odors are kept to a minimum during warm weather by providing a continuous drip of Cloroben into the influent channel of the settling tank. Because of the high grease content of this primarily domestic sewage, odors formed and grease incrustations were built up on the sewer interiors. These odors and grease deposits are now kept under control by installing at the end of the sewer a drip tank which contains a solution of Cloroben and water.

Activated sludge plant odors

At another installation which provided complete activated sludge treatment of the sewage prior to discharge into a tidal stream, Cloroben was also used very effectively for the control of odors and grease build-up. This plant concentrates the sludge prior to admission into the sludge digester. The skimmings are discharged into a sump pit where the material is retained, prior to pumping into the digester. During warm weather, after any appreciable delay in pumping, offensive odors developed very rapidly. These odors are controlled by spraying the contents of this holding sump daily with a solution containing approximately one pint of Cloroben.

The chemical, in dilute solution, was also sprayed into the digester whenever the scum built up to any extent under the digester cover. The spraying of the scum in the digestion tank with the chemical tended to keep the top solids soft and prevented them from solidifying and becoming a dense and hard cake. At this same plant, Cloroben was utilized as a "jack-of-all trades" wherever and whenever there was a possibility of odor formation or where actual odorous conditions developed. As an example of this usage, whenever any tank was taken out of service and emptied, prior to cleaning, a solution of the chemical was sprayed on the tank walls for odor control.

Septic tank odors

Recently, the author was faced with the problem of offensive odors on a large scale in many small plants consisting of septic tanks, tile fields, soil absorption beds, or covered sand filters. Many ways of correcting the existing difficulties were tried, including the use of a plank of proper length to break up the scum in the septic tanks.

We had good fortune in keeping sewage collection systems free of grease incrustations and odors, and had succeeded in keeping a primary sewage treatment plant free from odors by the addition of small amounts of Cloroben.

It was tried and we concluded that the addition of a relatively small amount of Cloroben into the dosing or pump chamber for any disposal facility, such as a soil absorption bed or sand filter, would keep the facilities operable for a considerable period of time before the sand and tile lines become clogged with grease and settled sewage solids. Since this method of treatment of a septic tank effluent proved successful, the life of many similar small facilities, such as septic tanks and tile field units installed throughout the country, may be extended and the expenditure of additional monies to replace or rebuild failing facilities postponed indefinitely.

In an effort to correct the problem of eliminating or diminishing many complaints due to foul sewage odors, the author investigated proven successful methods, in order to benefit from experience gained by others with similar problems. During research he found a translation of an extremely interesting article by C. von Malmborg, of Vasteras, Sweden in "Hygienisk Revy," 1956.

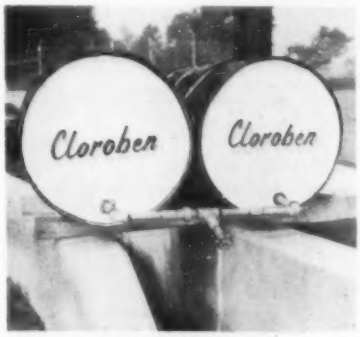
In a series of laboratory experiments conducted in Sweden, it was observed that Cloroben was effective in the killing of pathogenic bacteria and organisms normally present in sewage. The Swedish results obtained using various concentrations of Cloroben in water solution showed that:

(1) Non-spore forming bacteria (the group to which most of the bacteria belong, including the types most important in sewage works practice) were killed at a concentration of 1:1,000 after 5 minutes, and in a 1:10,000 concentration within 2 hours.

(2) Spore forming *bacillum subtilis* were killed after 5 minutes at a concentration of 1:10.

(3) *Typhus bacteria* were killed at a concentration of 1:500 in 5 minutes and the *coli bacteria* at a concentration of 1:500, in 10 minutes.

(4) At a concentration of 1:300 calf *diarrhea bacillus* was killed within 5 minutes; *paratyphus bacillus* within 10 minutes; *staphylococcus* within 20 minutes; and *streptococcus* within 50 minutes.



Cloroben solution, applied at tank inlet, overcame odor complaints.

Copyright 1958 by The Reuben H. Donnelley Corp. Reprinted by permission.

Yours on Request: Cloroben Technical Bulletin

Desirable Distributorships Still Available

CLOROBEN CHEMICAL CORPORATION

Subsidiary of Standard Chlorine Chemical Co., Inc.

115 Jacobus Avenue
South Kearny, New Jersey

New Jersey: MItchell 2-1703
New York: BArclay 7-4443

Wastes." By Gerald W. Lawton, George Breska, L. E. Engelbert, G. A. Rohlich and Nandor Porges. *Sewage and Industrial Wastes*, August, 1959.

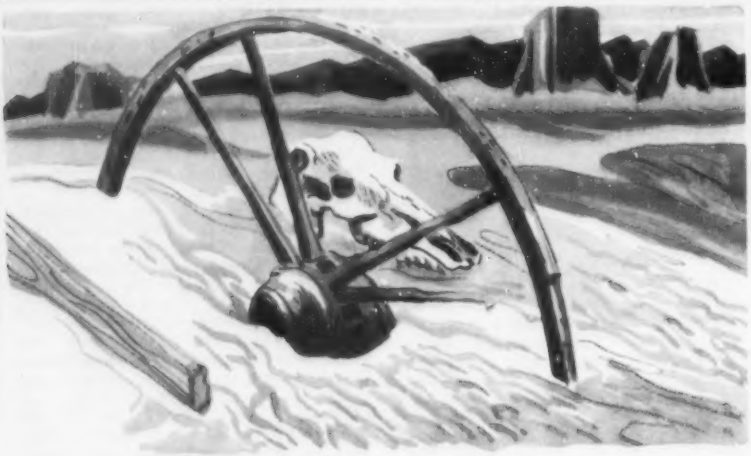
Automobile Manufacturing Waste Treatment

The wastes from Chrysler Corporation's 80 plants vary considerably in character and quantity, but include chromic acid from plating processes and from prepaint phosphating operations, cyanide containing liquors from plating, and oily wastes from machining. The necessity for continuing to use processes producing cyanide wastes has been evaluated at each plant, and in some cases substitution of other methods has been feasible. A typical cyanide waste treatment arrangement used where continued plating operations were deemed necessary, involved automatic control of water use in rinse solutions by means of a conductivity actuated valve. Overflows and drainage were trapped and treated with sodium hypochlorite prior to discharge to the city sewer. Chromium wastes from chromium plating were subjected to acidification to a pH of 2, reduction with sodium metabisulfite, neutralization and settling of the precipitated chromic hydroxide. Oily wastes present the most serious problem and efforts have been directed at attempting to reduce the quantities of wastes produced and to concentrate them. The use of central systems for coolants is practiced to keep coolants free of metallic particles and to provide sufficient aeration for avoiding bacterial decomposition of soluble oil. These measures made it unnecessary to dispose of coolants or to employ phenol germicidal additives in cutting oils. Flotation systems are used for many of the process wastes. These involve flocculation with caustic soda, alum and sulfuric acid, followed by air injection under pressure. Subsequent release of pressure produces the bubbles for effective flotation. It was found that by hot acid treatment of the sludge, the oil emulsion could be broken and free oil recovered. About $2,000 per month was saved by avoiding the cost of hauling the sludge to a disposal area.

"Treatment of Industrial Process Wastes at Chrysler Corporation." By A. R. Balden. *Sewage and Industrial Wastes*, August, 1959.

Algae Stabilization of Industrial Wastes

The most significant factor in whether the use of oxidation ponds for treatment of an industrial effluent is feasible is land cost. Others are possibility of pollution of ground water, number of days of sunlight, condition of waste for effective light penetration, and topographical conditions. Generally, a stabilization basin designed on the basis of a loading of 50 lbs. of BOD/day per acre of surface will be satisfactory. This is based on the average plant load and assumes that peak loads will not persist several days. Satisfactory operation under higher loadings have been reported for sanitary sewage of 83 lbs. of BOD/day per acre; for kraft mill effluents of 130 lbs. with 80 percent removal; for an organic chemical plant nearly 100 lbs. with 95 percent removal; and for a petrochemical plant, 75 lbs. with 90 percent removal. The normal depth for stabilization basins appears to be 4 to 5 ft. Shallower basins apparently are more effective for algal aeration, but vegetation growth may be a problem. A pond working effectively at 9 feet has been reported. The stabilization basin provides a sound method of biological oxidation of a plant effluent. The successful use of stabilization basins on a

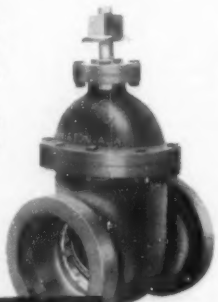


DEATH in the DESERT

If you have ever seen a desert or picture of a desert, you realize it is a scene of death. There may lie the bleached bones of an animal or a human being. There are no trees, no vegetation. The soil may be rich in plant food, but nothing grows. It is proof that water is the lifeblood of everything that grows—animal or vegetable.

It is an historic fact that past civilizations have risen and fallen according to their ability to satisfy their need for water. Water's abundance in America in the past is now deceiving. Not that the U. S. is turning into an arid desert, but the problem is inadequate water distribution facilities. U. S. water works improvements have not kept step with the phenomenal increase in population and industrial expansion, which means increased demand for water.

U. S. water works officials know this situation and are trying to solve it, but they need better public support.



This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

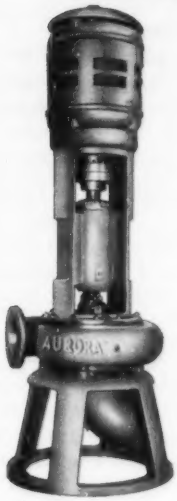
SUBSIDIARY OF W WALWORTH

OBJECTIVE PERFORMANCE

. . . EFFICIENCY AND ECONOMY WITH

AURORA® *Heavy Duty*

NON-CLOG PUMPS



TYPE KUC VERTICAL—For compact installation with flexible coupling drive . . . motor high above floor.

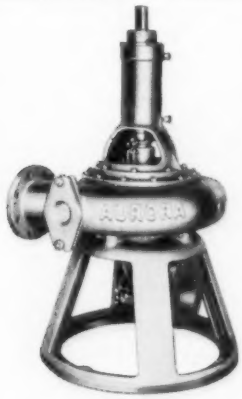
TYPE KCM VERTICAL—Utmost compactness . . . close-coupled design . . . low suction.

For handling heavy liquids . . . and solids in suspension. Ideal for public utility and industrial wastes.

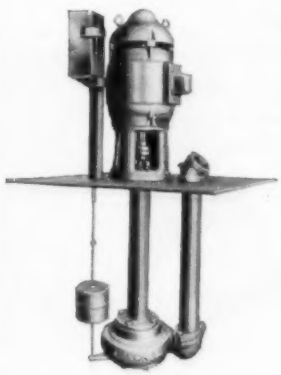
Capacities to 9000 GPM • Heads to 150 feet • Solids size to 6 inches

- Easy Installation
- Easy Disassembly
- Smooth—Quiet operation
- Hand cleanout provided in casings
- Detachable suction and packing covers
- Large Passageways
- Many optional features available
- Uniquely balanced impellers
- Engine or combination drives available
- Deep packing boxes

ALTERNATE IMPELLER DESIGN



TYPE KU VERTICAL—For flexible shaft drive . . . misalignment proof . . . elevated motor protection against pit flooding.



TYPE KS VERTICAL SUMP—For heavy duty wet pit service. Complete unit engineered to specific pit requirements.

TYPE KGG HORIZONTAL—Rugged base mounted unit . . . for use where suction conditions permit horizontal mounting.

ASK FOR . . .

MONO-VANE BULLETIN 121MV

NON-CLOG BULLETIN 121A

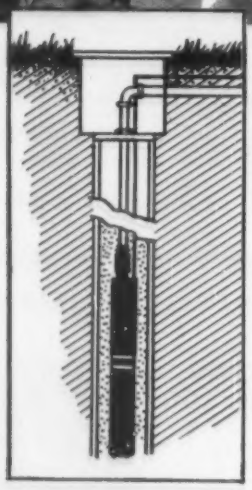
SUMP BULLETIN 104

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
630 LOUCKS • AURORA, ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

Picture of a 2000 gpm SUMO Submersible water pump installation!



Yes! That's the beauty of a Sumo Submersible. No pump house or other protection is needed to safeguard the motor against freezing, dampness or tampering. The Sumo Submersible operates completely inside the well — pump and motor both — under water.

The idea is not new. It's not radical. It's just plain commonsense engineering as Sumo has proved after almost 50 years of specializing in the submersible pump field. The motor is coupled directly to the pump and forms a complete, compact unit that makes more efficient use of power . . . provides a neater, simpler installation . . . and assures long, troublefree operation.

Sumo Submersible Pumps come in a full range of sizes up to 120 hp with capacities to 2000 gpm. Consider their use for any deep well requirement whether it be commercial, industrial or municipal. They'll quickly pay for themselves.

Write for information. Ask for literature on Sumo high-capacity pumps. For specific recommendations, state your water requirements and the depth of the well. Engineering assistance is always available without obligation.

SUMO SUBMERSIBLE DRAINER PUMPS

For pumping water containing up to 20% solids. Ideal for dewatering or flooding or use in areas where internal combustion engine driven pumps present a hazard. Capacities up to 400 gpm. *Write for literature.*

SUMO PUMPS INC.

Dept. 3 P.O. Box 983 Stamford, Conn.

Warehouse Stocks: Stamford • Dallas • San Francisco

The Complete Line from 1/3 hp to 120 hp

rather wide variety of plant effluents indicates that if a waste will be amenable to any kind of biological treatment, it will be amenable to oxidation in a stabilization pond. However, keeping in mind other cost considerations and considering the diversity of chemical products, pilot plant testing of a new waste in a stabilization basin would be practically mandatory.

"Oxidation of Organic Wastes in Stabilization Basins." By William M. Steinfeldt and Jack T. Garrett. PUBLIC WORKS, September, 1959.

Field Assaying Refinery Wastes

As a part of a research project sponsored by the Oklahoma Refiners' Waste Control Council, administered by the Oklahoma State University Research Foundation, a mobile laboratory was constructed for field bioassaying refinery wastes. A house trailer was stripped of its furnishings and was equipped with waist-high metal tables to contain the observation tanks. Constant temperature is maintained by air conditioning and electric heating. An oxygen pump is used for test solutions. Bioassays have been performed on more than 400 samples of effluents, with approximately a week spent at each refinery. In the test procedure, six dilutions are used with fat-head minnows and a maximum of 14 separate tests can be performed simultaneously. It is anticipated that trouble spots can be detected and proper treatment initiated before the individual waste segment becomes a part of the final effluent of a refinery. One of the objectives is evaluation of the various methods of treatment employed. It has been shown that lagooning is effective in reducing toxicity if sufficient holding time is provided. The sampling schedule has served to stimulate active interest in improved waste disposal.

"Mobile Laboratory for Assaying Refinery Wastes." By Marvin T. Edmison. *Industrial and Engineering Chemistry*, August, 1959.

Departmentalizing Waste Treatment Costs

Each department of an industry should be charged with portions of the investment in waste treatment facilities and assessed its proper share of operational and maintenance costs. Without such allocation the plant cannot provide treatment processes and plan for their economical operation. Formulas are derived by the author for allocation

NATCO TRI-FILTER BLOCK

NEW UNDERDRAIN UNITS

for improved performance in trickling filters

DESIGNED FOR:

Maximum efficiency

- Aeration area increased
- Greater runoff capacity

Faster, easier installation

- Reduced laying time with only 7 units required to the square yard
- Increased bearing area for channel and perimeter cover blocks
- Simplified layout with 12″ center-to-center spacing

High compressive strength—Low absorption rate

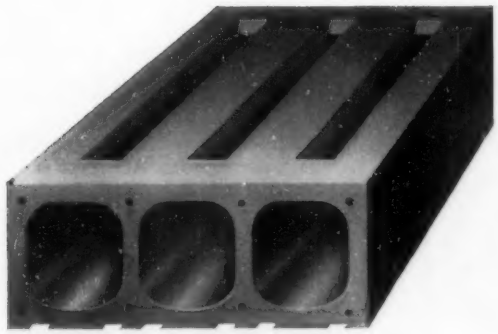
- Tested to loads up to several times that required by ASTM C 159
- Less than 6% water absorption by standard 1-hour boil method

Complete assortment of supplementary shapes

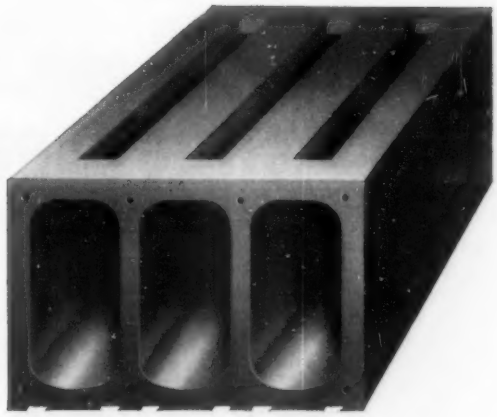
- Fractional, filler blocks, reducers, extensions, miters and cover blocks
- Layout and takeoff service
- Quick delivery

The new Natco vitrified clay TRI-FILTER block combines maximum capacity, both in drainage and aeration, with high strength, ruggedness, permanence and corrosion resistance, and all at minimum cost.

	Tri-Filter #5 Standard-Rate	Tri-Filter #8 Hi-Rate
Size	4¾″ x 11¾″ x 15½″	7½″ x 11¾″ x 15½″
Weight per unit	28 lb.	41 lb.
Weight per sq. yd.	196 lb.	288 lb.
Aeration per sq. ft.	39.3 sq. inch	39.3 sq. inch
Aeration %	27.3%	27.3%
Runoff sq. inch/lin. ft.	30.9 sq. inch	52.4 sq. inch
Runoff %	55.4%	59.3%



Tri-Filter #5
Standard-Rate



Tri-Filter #8
Hi-Rate

For additional information and shape details write to:

NATCO CORPORATION

GENERAL OFFICE: 327 Fifth Avenue, Pittsburgh 22, Pennsylvania
BRANCH SALES OFFICES: Boston • Chicago • Detroit • Houston • New York • Philadelphia • Pittsburgh Syracuse • Birmingham, Alabama • Brazil, Indiana • **IN CANADA:** Natco Clay Products Ltd., Toronto

NATCO QUALITY CLAY PRODUCTS SINCE 1889

of costs based on 1) the distribution of the hydraulic load volume, 2) the distribution of the concentration load, 3) if special treatment cost is involved, or 4) the average of both hydraulic and concentration load costs. Examples are given to show that both quantity cost and concentration reduction cost should receive joint consideration. As new fixed costs occur, particularly when new equipment or facilities are installed, such variations should be carefully included in the accounting process.

"Allocating Wastes Treatment Costs to Industrial Department Operations." By R. H. L. Howe and K. W. Coers. *Wastes Engineering*, August, 1959.

Other Articles

"Stainless Steel Anti-Smog Mufflers Cut **Air Pollution.**" Tests of afterburner type mufflers on Los Angeles city school and transit system buses show them to be 97 percent effective in eliminating smog-producing hydrocarbons from engine exhausts. Journal of the Air Pollution Control Association, August, 1959.

"Performance of a Flue-fed **Incinerator.**" An investigation of the usual apartment house incinerator shows the need for design modifications to minimize their effect on community air pollution. By E. R. Kaiser, J. Hallitsky, M. B. Jacobs, and L. C. McCabe. Journal of The Air Pollution Control Association, August, 1959

"**Determination of Radioactive Strontium.**" Analytical methods are discussed for strontium-89 and strontium-90 including procedures for treating different materials and removing interferences. By A. S. Goldin, R. J. Velten, and G. W. Frishkorn. Analytical Chemistry, September, 1959

• • •

The Ohio State University Gives College of Engineering Professional Status

An academic reorganization of the Ohio State University College of Engineering has been approved by the university's Board of Trustees. Major changes included establishment of a Pre-Engineering Division for the first two years of pre-professional study and a Professional Division for the last three years of the five-year program. Graduation requirements are based on the successful completion of the work of the Professional Division.

Under the new plan students will be admitted to the Professional Division of the college upon completion of a two-year pre-engineering program. The pre-engineering studies may be taken in the Pre-Engineering Division of Ohio State's College of Engineering, or at accredited liberal arts colleges, including the Ohio State College of Arts and Sciences, branch campuses and any other colleges and universities offering a comparable curriculum in pre-engineering.

The pre-engineering curriculum will be common for all branches of engineering, with the exception that students who expect to enroll in any of the chemically based curricula in the Professional Division will schedule two courses in quantitative analysis which would not be required of students who enter any of the other professional curricula. The program in pre-engineering will include work in English, mathematics, physics, chemistry, engineering drawing and engineering mechanics. Also included is the equivalent of nearly one quarter's work in the humanities and social sciences and the university requirements in physical education and military science. Admission to the Professional Division will be contingent upon completion of this work, or its equivalent, with an average grade of "C" or better.

Dean Harold A. Bolz said: "In line with current national trends in engineering, all of the new Professional

NEW MINIATURIZED WILKINSON LINE LOCATOR

MODEL W-3

Radically new, powerful, transistorized locating instrument weighs only 4 lbs. and is ¼ as large as old type pipe locators.

Telescoping aluminum handle; 2 oz. single ear set; all in carrying case.

Write today for brochure and instruction manual.

WILKINSON PRODUCTS COMPANY

3987 Chevy Chase Dr., Pasadena 3, Calif. SYlvan 0-4314

Learn how "AUTOMATIC SUPERVISOR" on truck promotes savings and safety . . .

WAGNER SANGAMO **TACHOGRAPH** graphically records starts, idling, stops, speeds of run

A Tachograph mounted on the dash of a truck might well be called an "automatic supervisor." It is a recording speedometer that graphically records trip information needed to make fleet operations more efficient. For a little more than 2¢ per day (the cost of a Tachograph chart) you gain facts that help you reduce wasted time, encourage safer driving and control speed. A Tachograph on a vehicle is almost like having a supervisor actually ride along on every trip. For details, mail the coupon.

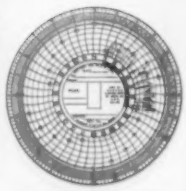


CHART TELLS ALL

Wagner Electric Corporation

6356 PLYMOUTH AVE. • ST. LOUIS 14, MO.

Please send a copy of Bulletin SU-3

Name_____

Company_____

Address_____

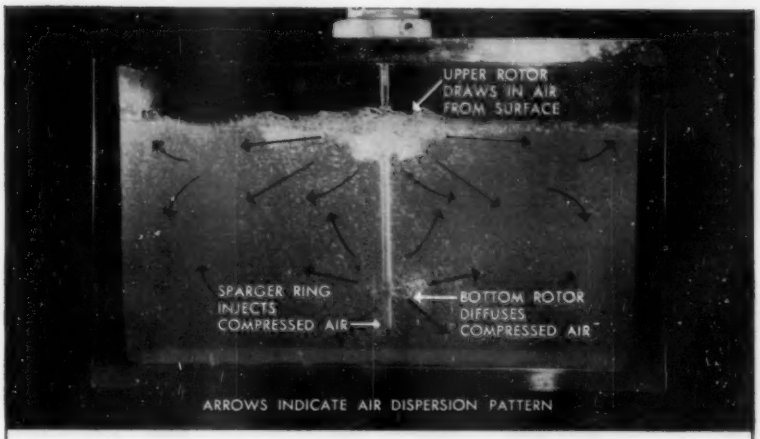
City_____ State_____

We operate_____ Vehicles

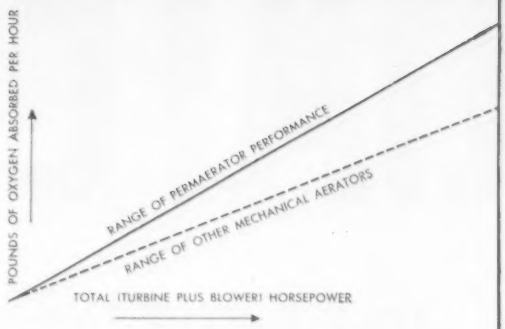
W559-4

FLUIDICS

is a Pfaudler Permutit
program providing
the know-how
the equipment
and the experience
for solving problems
involving fluids


UPPER ROTOR DRAWS IN AIR FROM SURFACE
SPARGER RING INJECTS COMPRESSED AIR
BOTTOM ROTOR DIFFUSES COMPRESSED AIR
ARROWS INDICATE AIR DISPERSION PATTERN

GRAPH ILLUSTRATES O_2 TRANSFER EFFICIENCY OF PERMAERATOR COMPARED WITH OTHER MECHANICAL AERATORS UNDER IDENTICAL OPERATING CONDITIONS:


POUNDS OF OXYGEN ABSORBED PER HOUR
RANGE OF PERMAERATOR PERFORMANCE
RANGE OF OTHER MECHANICAL AERATORS
TOTAL (TURBINE PLUS BLOWER) HORSEPOWER

FLUIDICS AT WORK

New PERMUTIT PERMAERATOR

Increases O_2 transfer over 65% without adding power . . . with Permutit's new process Bio-Oxidation Aerator

Developed in laboratory and pilot plant operation, now confirmed and proven in a large industrial waste treatment installation, Permutit's Permaerator sets a new high in rate of oxygen transfer per horsepower.

Permutit's design of the double turbine introduces oxygen from the surface as well as from a sparger ring. Oxygen transfer per horsepower has increased from conventional rate of .86 lb. per hour to 1.5 lbs. per hour.

Permutit's Permaerators can be installed in existing basins as well as in new systems. To help you achieve such efficiency in your Bio-Oxidation system, we will be glad to review your operating data and make recommendations.

Other Pfaudler Permutit equipment for waste treatment includes: Colloidair Separators, Precipitators, Titan Centrifuges, Ion Exchangers, Filters, Chemical Feeders, Evaporators, and Degasifiers. Call or write Permutit Div. Dept. PW-109, 50 W. 44th St., New York 36, N. Y.

FLUIDICS covers such varied phases of fluid handling and control as:

waste treatment	distillation
water treatment	drying
corrosioneering	blending
reactions	metering
polymerization	valving
ion exchange	flow rate control
fluid analysis, metering and control	piping
	storing
	centrifuging
agitation	filling
evaporation	heat transfer, etc.

Whenever you have a fluid-handling problem, look to the Pfaudler Permutit FLUIDICS program for the best solution.

PFAUDLER PERMUTIT INC.

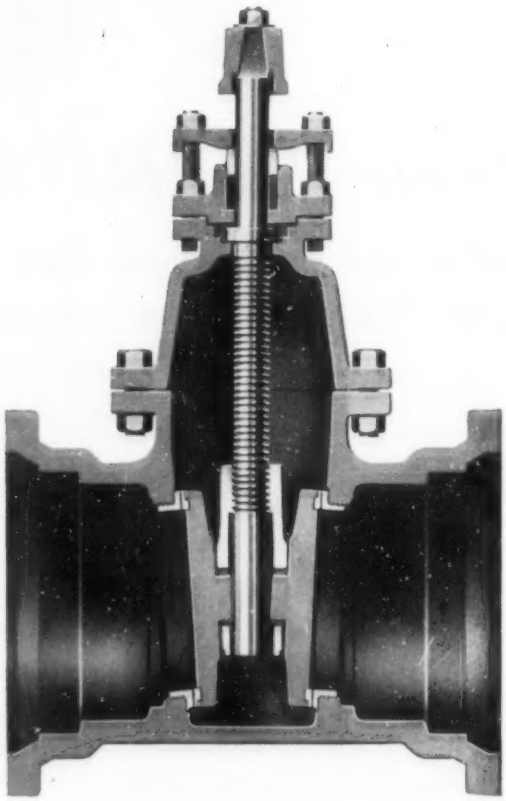
Specialists in FLUIDICS . . . the science of fluid processes

R.D. WOOD GATE VALVE

THE R. D. WOOD GATE VALVE...
DESIGNED TO BE
BURIED AND FORGOTTEN

- So simple and sturdy that it lasts for generations
- Always ready to operate when needed
- Only 3 moving parts—the spreader and two discs

Available with conventional or "O" ring packings
Conforming to AWWA specifications



R. D. WOOD COMPANY

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe
(centrifugally cast in sand molds)

Southwest Representative: Kenneth F. Pogue, Dallas, Texas

Division curricula place greater emphasis on both breadth and depth in the engineering sciences, mathematics and basic science at the expense of 'know how' courses on specific types of machinery or processes. However, with the five-year program it has been possible to place greater emphasis on engineering systems courses than is usually possible in a four-year curriculum.

"Thus, the young engineer," the dean said, "has the opportunity to apply the principles learned in his engineering science courses to the synthesis, design and analysis of an integrated engineering system; and, under the guidance of experienced professors, he learns to appreciate some of the design compromises and considerations for economics, reliability, safety, maintenance and manufacturing feasibility, which are the essence of experienced engineering judgment. Under this new plan the College of Engineering will continue its policy of providing superior students with the opportunity of spending the fifth year in the Graduate School and of receiving both the bachelor's and master's degrees at the end of the five-year period."

Freshmen entering the program this coming fall will complete 15 quarter hours of work in the humanities and social sciences in the pre-engineering curriculum and a total of 35 quarter hours of such work in the five-year curriculum. All students will complete at least one or two courses each in history and literature, as well as elective courses in such areas as economics, sociology, psychology, philosophy and the arts. For the first time at will be required to complete at least Ohio State, all engineering students five quarter hours of work in a biological science.

• • •

Specifications and Development

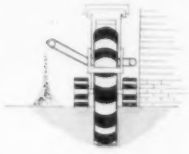
A four-point study program has been set up for the Specifications and Development Committee of the Contractors' Division, American Road Builders' Association.

The committee plans investigations of: 1) Specifications for embankment compaction, including present methods and equipment specified, and methods of testing results; 2) Developments in the bituminous concrete field to increase the productivity of yardage of pavement placed; 3) Methods of lengthening the construction season; and 4) Special problems encountered in urban construction.

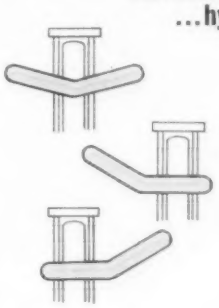
THE MACHINE / for distribution digging

...the new Cleveland J-20 trencher

- less than 5' wide over its crawlers
- digs 13" to 24" wide, down to 5' 6" deep
- puts 24" trench within 20 inches of a parallel wall
- maneuverable full crawler mounting ... perfect balance and stability, easy on lawns and sidewalks
- fast, accurate, clean, dependable ... nothing digs trench like a Cleveland

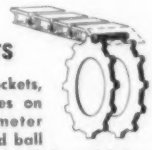


Cleveland's unique new V conveyor ...hydraulically shifted ... independently driven



- digs past poles, trees, shrubs ... places spoil where needed — without interrupting other operations
- lever at operator's seat controls hydraulic shifting and positioning of conveyor
- dual independent hydraulic drive gives operator fingertip control of conveyor belt direction and speed — independent of all other operations
- self-contained hydraulic motor and planetary gear drives in each head pulley eliminate all conveyor chains and sprockets
- provides constant elevating angle for faster, higher spoil discharge
- Maximum clearance under digging wheel rims permits higher heaped loads without clogging
- conveyor design reduces rolling and tumbling

world's finest trencher crawlers



... double flanged sprockets, rollers, wheels ... drives on each end of 1½" diameter hardened pins ... sealed ball and roller bearings ... 1,000 hour lubrication ... a tremendously long-lived, easy-rolling track.

hydraulic crumbing shoe

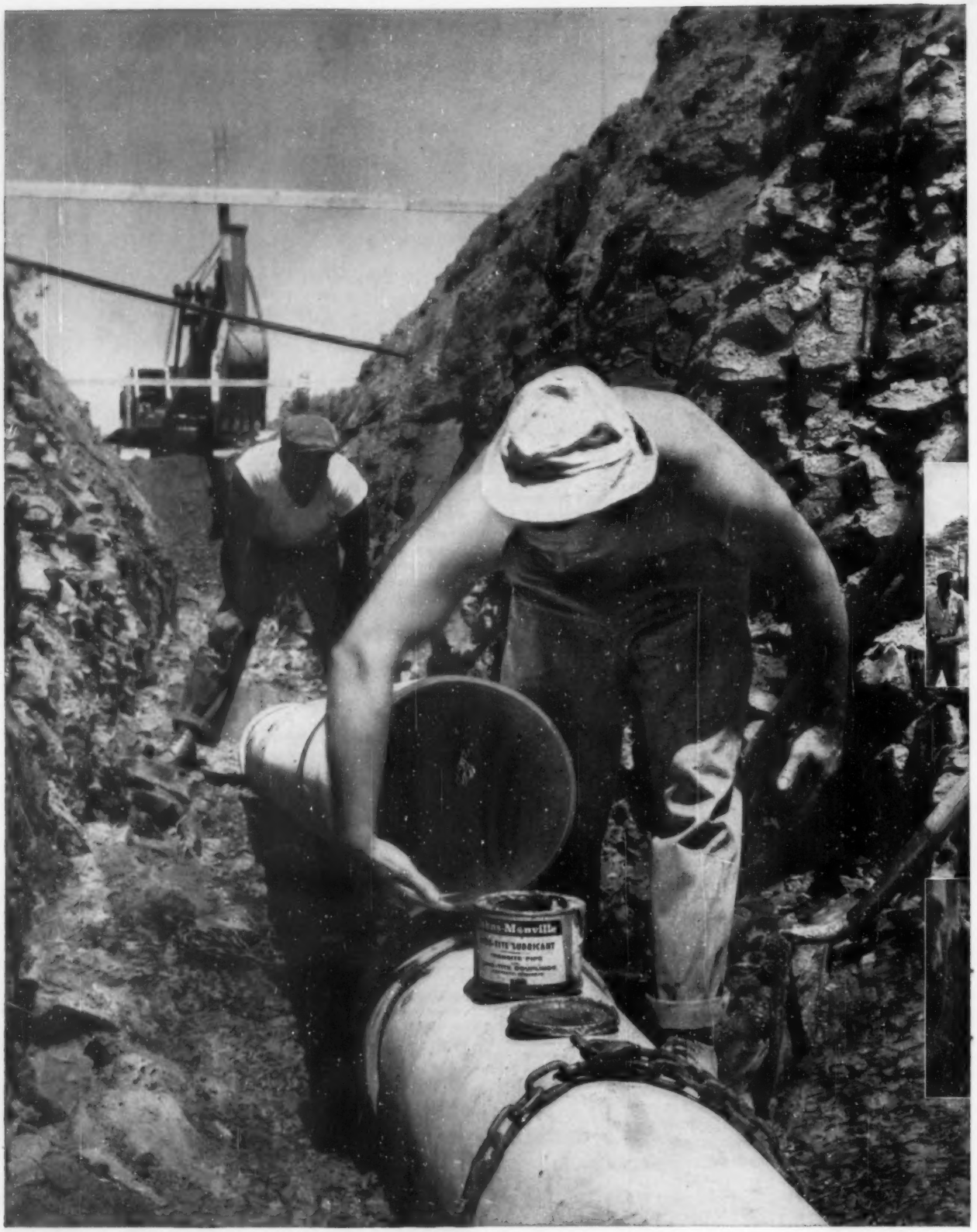
... optional, extra ... pivots upward ... fingertip control makes crumbing shoe advantages practical in crowded digging conditions.

engine • crawlers • hoist • wheel crumbing shoe • conveyor speed-direction-shift / *Every operation controlled at operator's seat*

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good *Everywhere*


Manville

"In one day we can install as much as 600 feet of 12" Transite Sewer Pipe"

Says Ernest Renda
E. Renda & Son Contracting Co.
Green Brook, N. J.

"Today the only way you can show a profit," says Mr. Renda, "is to increase your productivity—to lay more pipe per day. That's why we feel surer working with Transite"...

Mr. Renda continues

"It is easily handled on the ground and in the trench. It is quickly assembled and installed. It reduces job site operations to such an extent that we can work with fewer men. Another important Transite advantage is tight joints . . . and there are fewer joints to make. Never any trouble passing leakage and infiltration tests. Long Transite lengths give us a straighter line . . . better grade.

"Working with Transite gives us another advantage—the **Johns-Manville installation service,"** he continues. "Bob Anderson, the J-M field instructor (shown at right, center photo), constantly **advises me on new methods** used on other jobs. And ten years ago, it was this same instructor who taught me to assemble Transite so that I could teach my men how to install it."

Transite® Sewer Pipe installs quickly, easily to keep installed costs low . . . its smooth interior permits flatter grades . . . and the Ring-Tite® Coupling answers the toughest infiltration and root problems. Send the coupon for your copy of TR-206A—"The Book Designed with the Contractor in Mind." Mail the coupon now!

JOHNS-MANVILLE

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
Box 14PW, New York 16, N.Y.

Gentlemen: Kindly send me the informative, 16-page Transite booklet which is written especially for contractors.

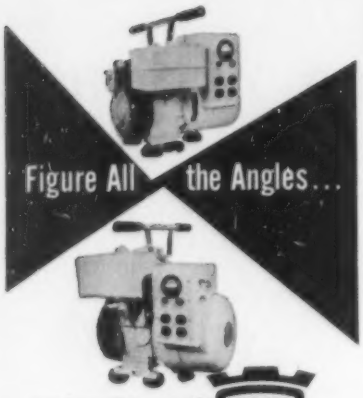
Name_____

Firm_____

Street_____

City_____

Zone_____ State_____



and you'll specify pm Electric Plants

Read how exclusive PM features put job pay-out dollars *right back in your pocket!*

- RPM indicator puts $70 each 6 months in your pocket!
- Automatic spark advance puts $60 every 6 months in your pocket!
- Pushbutton start puts $30 per month in your pocket!
- Remote control puts $30 per month in your pocket!

Write for free demonstration. There's a PM Field Engineer near you.

Pacific Mercury
13232 Leadwell
North Hollywood 9, Calif.

Manufacturers of the Thomas Electronic Organ

DOING ONE THING AND ONE THING WELL—

FOR OVER 60 YEARS!

ROBERTS FILTER MANUFACTURING CO.

DEPENDABLE MODERN

WATER PURIFICATION EQUIPMENT

CALL OR WRITE

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

GRAPHICAL METHOD FOR DETERMINATION OF FUEL CONSUMPTION

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Co.,
Kansas City, Missouri

OF THE MANY costs comprising the total expenses in the operation of a prime fuel generating station the item of "fuel" constitutes one of the major items in the cost of producing energy. It is not uncommon for fuel expenditures to run in the order of 30 to 40 percent or more of the total electric system operating costs. With such a preponderant influence on the annual operating budget, it is a matter of importance to predetermine periodically the amount of fuel consumption anticipated for each succeeding year's operations, based on known heat rates of individual existing and proposed new units in a given power station. This permits studies and analyses leading to economical selection of size for new units and of operational scheduling for existing generating units.

One method, which is universally applicable to the determination of fuel consumption for either steam or internal combustion engine plants, has been included hereinafter in the form of a graphical chart.

In this example a certain industrial type plant was considering the purchase of additional diesel engine generating capacity consisting of: (a) One 480 kw unit; or (b) Two 300 kw units; or (c) Three 250 kw units. At the time the study was made, the system peak load was 385 kw; however, the anticipated ultimate load forecast indicated a future demand in the order of 450 kw or more.

Referring to the chart, the steps taken to determine the annual fuel consumption anticipated for each of the three sizes of plant units listed above were as follows:

1. Curve A was plotted from system load characteristics with "Time in Hours" as the abscissa and with "Load in Kw" as the ordinate. This curve, which is the load duration curve, shows the peak demand at zero hours and the minimum load at 8,760 hours, with the area under the curve representing total kwh to be generated during the year.

2. Curve B was prepared from manufacturers' guarantees of hourly fuel oil consumption plotted against load in kw for each of the three sizes of generating units studies. In this example, it was proposed that the second 300 kw unit and the second 250 kw unit would be started up and put on the line whenever the load on the system exceeded 200 kw. The ordinates, "Load in Kw" for both Curve A and Curve B were plotted to the same scale.

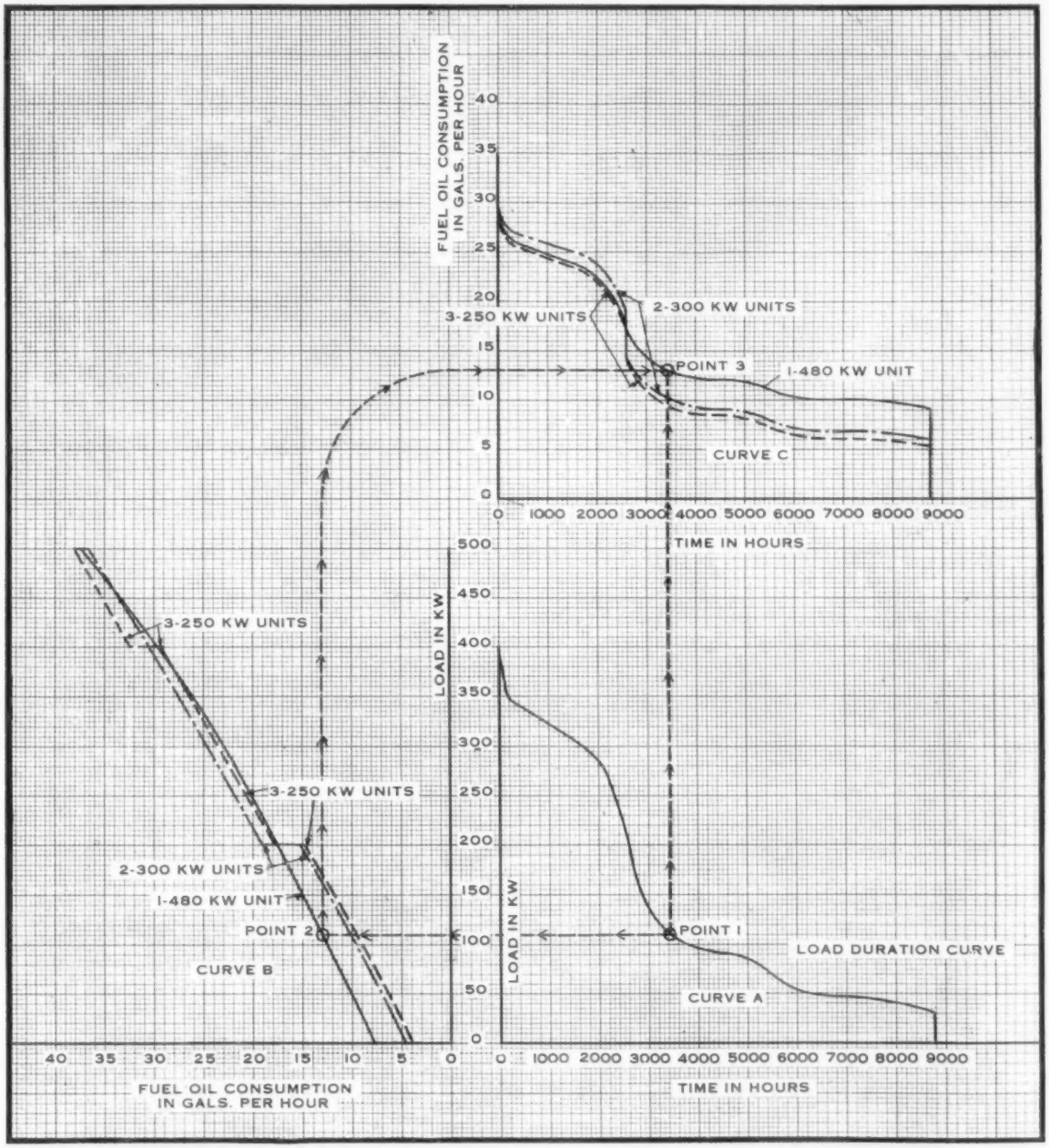
3. Curve C was derived by preparing an abscissa to the same scale and directly above Curve A to represent "Time in Hours." The ordinate axis of Curve C was to the same scale as the abscissa axis of Curve B, representing "Fuel Oil Consumption in Gallons per Hour." With the horizontal and vertical scales of Curve C established as described herein, the curve of annual fuel oil consumption for the 480 kw unit was plotted by starting at any given point such as Point "1" on Curve A, then projecting a line vertically upward to the locus for Curve C. Starting at the same Point "1," a horizontal line was projected over to intersect the 480 kw unit curve of Curve B at the point designated as Point "2." By orthographic projection, a line from Point "2" was extended up and to the right to intersect the line originally projected vertically upward from Point "1" at a point designated as Point "3," thus establishing a point on Curve C for the annual fuel oil consumption of

the 480 kw generating unit. By successive selection of other points on Curve A, projected vertically, horizontally, and orthographically, the remaining points were established to complete the 480 kw unit curve of Curve C.

In a similar manner, the annual fuel consumption curves for the 300 kw units and for the 250 kw units were established to complete Curve C. By using a planimeter, or counting squares, the area under Curve C, representing annual fuel oil consumption in gallons, was determined for each of the proposed generating units.

These data were then evaluated against first cost, maintenance, and other expenses to determine the most economical size of unit for the plant given in the example.

A graphical method like this for the determination of fuel consumption presents a simple and straightforward scheme which could readily be extended to include various combinations and operational scheduling of individual units in a given power plant. By subsequent analysis of several values of annual fuel consumption costs determined in such a manner, weighed against other operating costs applicable to the several possible combinations of unit scheduling (such as operating labor, maintenance, and the like) it should be possible to determine the most economical selection of new units or scheduling of operation for existing units for the individual power plant.



● **BY CONSTRUCTION** of Curve "C", various combinations of power units may be compared on the basis of fuel consumption.

Actual photo of a #6 residual fuel of the type burned regularly by two *Enterprise* Engines at the Municipal Power Plant, New Smyrna Beach, Florida.

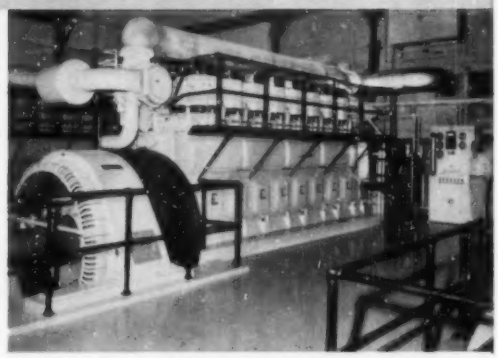
ENTERPRISE Does —and saves this city up to $4200 per month in fuel costs!

Here are facts of interest to any city that is thinking of using low cost residual fuels in engines for electric power generation.

Early in 1957, New Smyrna Beach, Florida put two DSR-38 *Enterprise* Diesels into operation generating 90% of its power load. They burn about 100,000 gallons of #6 residual fuel every month. *Both engines have now run on 80% average load continuously for over a year and a half without shutdown except for normal maintenance—with fuel savings as high as $4200 per month!*

This performance is typical of *Enterprise* Diesels. For they are designed and built to permit the widest possible latitude in fuel use. You can now order your new engine fully equipped for burning residual fuels. Or your present *Enterprise* Diesel can be converted to handle heavy fuel by installing the necessary oil heaters and centrifuges. No change in the basic fuel injection system is required if it's an *Enterprise*.

To be sure your diesel will handle low cost fuels and still turn in maximum performance—*without expensive maintenance and downtime*, specify Enterprise—custom crafted by the engine people that have the heavy fuel experience—and know how to use it!



These two 2500 HP *Enterprise* Model DSR-38 Turbocharged Diesels have turned in record performance on heavy fuel operation. Simple *Enterprise* open-type combustion chamber design makes handling of heavy fuels easy and economical.

ENTERPRISE
engine & machinery co.

DEPENDABLE ENGINES

Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California

Boston • Chicago • Jacksonville • Kansas City • Los Angeles
Minneapolis • New Orleans • New York • Pittsburgh
Seattle • St. Louis • Washington, D.C.

● **MULTI-USE** recreational area extends a mile between lake front and a busy highway. Both road and park are well lighted.

LIGHTING
Gives Full Recreational Use of Parks

W. J. VAN EFFEN,
Superintendent, Electric Dept., City of Escanaba, Mich.

LUDINGTON Park in Escanaba, Mich., is a recreational area extending over a mile in length along the shores of Bay de Noc. It features all yacht harbor facilities—club house, sailing, boating, fishing as well as swimming and a modern beach house. It also includes lighted tennis courts, shuffle-board courts, playground equipment, picnic facilities—a variety of recreational activities for both young and old.

Lake Shore Drive, a hilltop road which extends for about a mile along and overlooking Ludington Park, had been lighted by old twelve-foot ornamental cast iron standards. Extremely high maintenance costs and poor street lighting indicated that modern lower-cost street lighting was an economic necessity.

Both the need for better street lighting and the desire for park lighting led to an obvious solution —modern standards with twin brackets. We had a problem and a solution. All we needed was the engineering between them. Briefly, these are some of the problems which were encountered.

First of all, park use was seasonal, and we wanted to be able to disconnect the park circuit during the winter. We also wanted to turn this circuit off automatically after 11 pm. This was done by installing a photo-electric cell to control all the lights and a time switch to turn off the park circuit. Relays were attached at the end of each circuit for cascading controls.

Another problem was the mile-length of the project, where primary feeders were scarce, overhead lines were taboo and series circuits with their obsolete regulators were a step backward. The most feasible solution to this problem was the selection of a 480-volt multiple double circuit. This was supplied by three primary distribution feeders (one at 2300 volts and two at 7200 volts). These circuits were phased out and polarized to prevent unnecessary potential stress on the underground insulation.

The project is complete insofar as lighting both our Lake Shore Drive and Ludington Park is concerned. There are 29 Kerrigan tapered steel, octagon shaped, standards with 55 luminaires lighting the mile long strip on Lake Shore Drive. Westinghouse Class II luminaires were used over Lake Shore Drive and General Electric Class III luminaires were installed with 10° tilt over the park. The park is well lighted until 11 pm. which allows several hours of additional use of the many park facilities.

The Chamber of Commerce advertises this as the Million Dollar Lake Front; it cost over a million dollars to build, but less than 2 percent of that amount to light. The entire lighting job cost $17,328, which includes lights, standards, underground circuits and vaults. The unit cost average is $600 per standard and $316 per light.

The citizens of Escanaba are proud of this park. The many tourists have complimented us about the park and its lighting system. This project has made Escanaba lighting conscious, and the City has been getting many requests for more lighting like that at the park.

● **LIGHTING** standards along Lake Shore Drive. There are 29 Kerrigan tapered steel octagon standards with 55 luminaires. Westinghouse Class II luminaires were used over the Drive and GE Class III on the Park. Unit cost was $316 per light.

● **SEWER CLEANING** in Spokane proceeds without effort on the part of the two-man crew, since the machine does the work.

We HAD A Sewer Problem!

JAMES W. DAY,
Sewer Supervisor,
Spokane, Washington

EVERY CITY has its problems, and in Spokane, sewer maintenance was one of ours. Since World War II the miles of sewers in our fast-growing city have almost doubled. In addition, since nearly all sewers are of the combined type, storm water debris from new streets added greatly to the work.

Our annual sewer cleaning schedule had been carried on for years by means of Flexible rods and power drives. As the sewer system grew in both length and load it became necessary to increase man power or increase the output of our present force in order to continue our essential sewer maintenance schedule. Accordingly, a Flexible SeweRodeR was purchased by the City.

Local conditions were considered carefully in the selection of equipment for the Sewer Department. The majority of the combined sewers are 8, 10 or 12 inches in diameter, and equipment capable of working 6 to 15-inch pipe is necessary. We found that the sectional steel rod has enough stiffness to remain straight and convey power to the cutting tool and will not double back in sewers of this size. The SeweRodeR pushes, pulls and rotates the rods without physical effort on the part of the men. Its use requires only two men and we average more than 3,100 feet of sewer cleaned per day.

For cleaning sewers over 15 inches in diameter we use a set of Flexible power bucket machines. The SeweRodeR is used to thread through the sewer from manhole to manhole and to pull back the ½-inch cable for the bucket machines.

Because Sewer Division officials feel that working conditions for the sewer crew are just as important as conditions for the Department workers at City Hall, we had the SeweRodeR mounted on a truck and a cab built for the operator. For warm sunny days the cab door can be kept open and the windows lowered, while in bitter cold weather the operator can turn on the heater that is piped back from the motor of the machine. Normal operation in all kinds of weather insures the most return for the tax dollar. The small expenditure for the cab is more than offset in work accomplished and the attitude of the crew. Not one day has been lost due to weather conditions since we made it possible to work in rain, snow or sunshine.

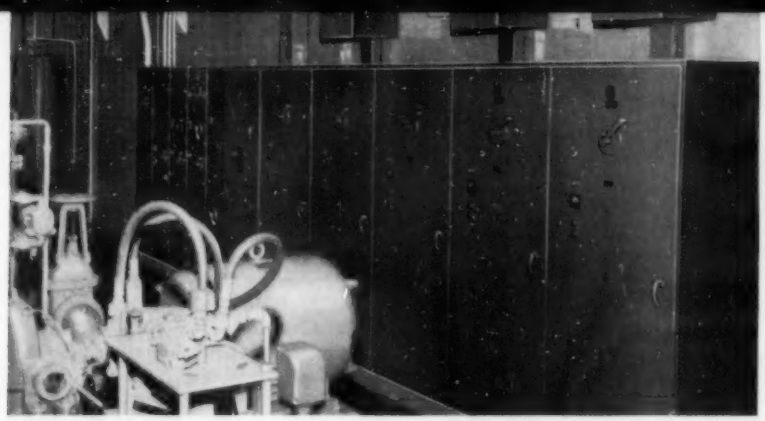
Purchase of the SeweRodeR has proved to be a wise decision. With it we have been able to continue our cleaning schedule, and in fact improve upon it, without increasing our work force. We anticipate the purchase of another SeweRodeR in the not too distant future as the sewer system continues to grow.

● **THE AUTHOR** stands by the enclosed cab of he SeweRodeR, which permits sewer cleaning in all weather.

"AS SPECIFIED" Lake Forest's New Water Treatment and Pumping Station Equipped with Cutler-Hammer Unitrol

LAKE FOREST, ILLINOIS WATER TREATMENT & PUMPING STATION

Capacity: 7,200,000 gallons per day
Superintendent: G. L. Watson
Resident Engineer: H. R. Von Huben
Consulting & Design Engineers: Greeley & Hansen, Engineers
Electrical Contractor: Art Electric Co., Inc.



CONTROL CENTER #1 Compact grouping of the high lift pump control, main circuit breaker, and pump room auxiliaries Unitrol section cut installation costs . . . promotes efficient, trouble-free operation and maintenance.

CONTROL CENTER #2 Front-and-back Unitrol Construction places the control for the stirring machines, ventilation, de-watering pumps and feeder circuit breaker in the main lobby; and the controls for the boiler, air-compressor, and wash water pump in the adjacent boiler room.

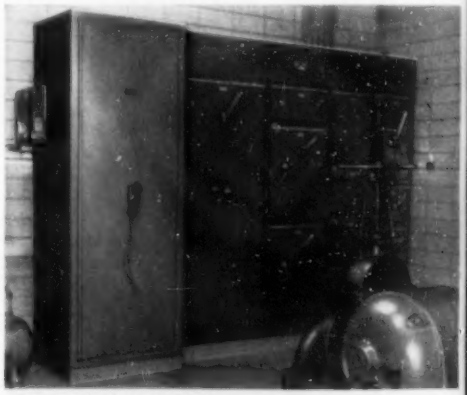
Men who know choose Cutler-Hammer Unitrol

Unitrol simplifies plant design, costs less to install. Exact dimension and construction details are known, eliminating false starts in plant layout and costly on-the-job revisions . . . no special floor or wall preparations are required . . . no hidden installation extras.

Unitrol is *first* in performance and dependability. Extra-life vertical contacts stay clean and trouble-free. Adjustable overload relays work every motor up to rated capacity safely without needless pumping interruptions caused by nuisance tripping. Full three-phase, 3-coil overload relays easily included whenever desired.

Unitrol Control Centers never become "orphans." Complete factory records are maintained so that whenever pumping facilities are expanded the Unitrol Control Center "grows" without having to re-engineer the total job. This feature alone has saved thousands of dollars for many rapidly growing municipalities.

Be sure you have all the latest facts on Cutler-Hammer Unitrol . . . its many extra features assure you better plant design, important installation savings, and dependable trouble-free operation. Write now for the new descriptive bulletin EN142-U204 Cutler-Hammer Inc., Milwaukee 1, Wisconsin.



REMOTE PUMPING STATION Earlier improvement to Lake Forest's water system included the construction of a 2,000,000 gallon underground tank and remote controlled pumping station. Here, too, Cutler-Hammer Unitrol is used to control the electric motor driven equipment.

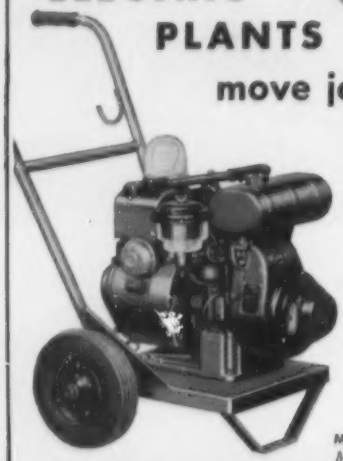
CUTLER HAMMER CONTROL CH

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • Division: Airborne Instruments Laboratory. • Subsidiary: Cutler-Hammer International, C. A.

Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation.

Portable
KOHLER
ELECTRIC
PLANTS
move jobs faster



Lightweight Kohler plants quickly pay back their cost—and more—in work time saved. Easy to truck or move where needed for power tools, floodlights, on street and park maintenance jobs . . . Emergency plants for police communications, treatment and filtration plants, when normal power fails. Sizes to 100 KW, gasoline and diesel. Write for folder E-8.

KOHLER CO. *Established 1873* KOHLER, WIS.

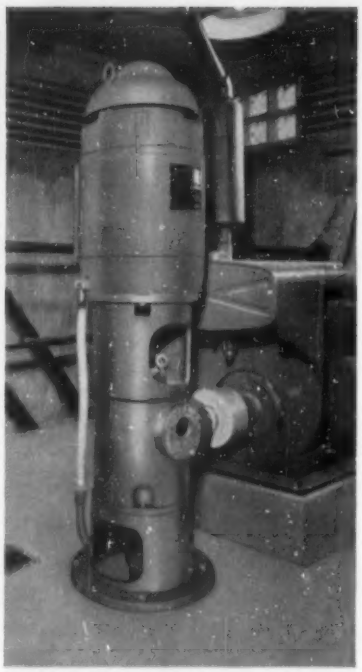
MODEL 1.5M25, *1500 watts, 115 volt, AC. Manual start. 2500 watt AC models available.*

KOHLER OF KOHLER

Enameled Iron and Vitreous China Plumbing Fixtures • Brass Fittings
Electric Plants • Air-cooled Engines • Precision Controls

For positive protection
against power failures, install

JOHNSON
Right angle
GEAR DRIVES



Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

Sizes: 15 to 450 hp. Johnson Right Angle Gear Drives are available in combination, dual and standard types; for all horizontal prime movers; hollow or solid shaft. Please write for engineering catalogs.

7-R

JOHNSON • MAKERS OF FINE GEARS SINCE 1904
GEAR & MANUFACTURING CO., LTD.
8TH AND PARKER STREETS • BERKELEY 10, CALIFORNIA

BOOKS IN BRIEF

(*Continued from page 22*)

second, entitled "Performance of Doweled Joints Under Repetitive Loading," by Leslie W. Teller and Harry D. Cashell, describes a device and procedure for load-transfer tests of full-sized joints under shear and flexure, and results of a series of tests to determine the effects of several variable factors. Bulletin 217; $1 each; available from Highway Research Board, 2101 Constitution, Washington, D. C.

SEALERS FOR JOINTS AND CRACKS IN CONCRETE PAVEMENT

Two papers sponsored by the Committee on fillers and sealers for joints and cracks in pavements and presented at the 37th Annual Meeting of the Highway Research Board are contained in Bulletin 211. "Laboratory Tests of Sealers for Sawed Joints," by W. H. Kuenning, covers the work during the period 1955 through 1957 in a continuing program of extensibility tests on such sealers, both conventional and in the developmental stage. "Comparative Testing of Joint Sealants in Sixteen Laboratories," by Egons Tons, reports on results obtained in a critical study of the bond-ductility, flow and penetration tests used for evaluating pavement joint and crack sealing compounds. Reproducibility was found to be lacking in the first two tests, indicating need for re-appraisal of the procedures and techniques. Copies of this 22-page bulletin are 50¢ each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

CATALOG LISTS REPORTS OF COMPUTER RESEARCH

A new Catalog of Technical Reports listing all reports in the field of computers available to the public from the collection of the Office of Technical Services, U. S. Department of Commerce, has just been published. The CTR identifies reports on digital, analog, photographic, mathematical, navigational computers and others. Many of the reports resulted from research conducted for the Army, Navy, Air Force, Atomic Energy Commission and other agencies of the U. S. Government. Others are German documents captured during World War II. All are for sale to the public, some in printed form and others in microfilm or photocopy. The list-

OLD DAN'L NEVER KNEW...

This newly completed concrete highway bearing the name of Daniel Boone speeds traffic through the very countryside old Dan'l once traveled and knew only as a tangled wilderness.

Modern construction genius employing Laclede's complete designed reinforcement service is helping create a multi-million dollar national system of expressways, of which the Daniel Boone is a part. To withstand the constant pounding of cars to and from ever-expanding suburbs, these new freeways must be built *strong*.

Much of the needed strength comes from Laclede designed reinforcing steels—multi-rib reinforcing bars, welded wire fabric, welded dowel spacers, center and recess joints, tie bars and accessories.

The section of the Daniel Boone Expressway shown above was built by Millstone Construction, Inc., St. Louis.

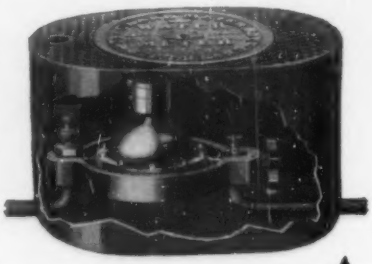
LACLEDE®

LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

CLARK METER BOXES AND COVERS
OF CAST IRON

Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.



Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

Below, A-2-13 Clark Meter Box Cover with screw lock. Height 4", lid opening 13".

Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

Improved Screw Lock with strong forged bronze bolt.

Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

Write for New Catalog

H. W. CLARK CO.
MATTOON, ILLINOIS

ings, CTR-371 Computers, 1937-58, may be ordered from OTS, U. S. Department of Commerce, Washington 25, at 10¢ each.

HIGHWAY STATISTICS, 1957

The Bureau of Public Roads has published a new 200-page bulletin, Highway Statistics, 1957, presenting statistical and analytical tables of general interest on motor fuel, motor vehicles, highway-user taxation, State and local highway financing, road and street mileage, and Federal aid for highways. Included this year are special tables on State legal and administrative provisions regarding motor-fuel taxation and motor-vehicle registrations and operators' licenses. The publication may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at $1.25.

WOOD CONSTRUCTION AND ASSEMBLY

Better utilization of wood through assembly with improved fasteners was discussed by Dr. E. George Stern, Head, Dep't. of Wood Construction, VPI, during a 4½-week lecture tour through Europe and Africa. He also surveyed European practices. The discussion is published in VPI Wood Research Laboratory Bulletin No. 38, free on request from the Laboratory, Blacksburg, Va.

CONSTRUCTION MATERIALS STATISTICS, 1947-57

A 52-page reference work for persons interested in construction and its materials contains details for more than 75 products. Production, shipments, inventories, orders, quantities and values are sections covered in this reference book. Copies are 35¢ each and are available from Supt. of Documents, Government Printing Office, Washington 25, D. C.

FROST EFFECTS IN SOILS AND ON PAVEMENT SURFACES

Bulletin 218 contains four papers presented at the 37th Annual Meeting of the Highway Research Board. The papers are as follows: "Frost Action and Load-Carrying Capacity Evaluation by Deflection Profiles," by C. K. Preus and L. A. Tomes; "Rhythmic Ice Banding in Soil," by R. Torrence Martin; "Icing on Pavements," by A. R. Jumikis; and "Frost Action and Railroad Maintenance in the Labrador Peninsula," by R. W. Pryer. 48-pages; $1 each; Highway Research Board, 2101 Constitution, Washington, D.C.

Aluminum Bus Stop Shelter

IS ATTRACTIVE and EASY to MAINTAIN

JOHN B. WENTZ
Administrative Officer
Beverly Hills, California

A UNIQUE shelter for bus patrons was installed recently at one of its more heavily used bus stops by the City of Beverly Hills, California. The all-aluminum structure will serve as a pilot study for possible installation of similar shelters at other bus stops.

The shelter is supported on a single pedestal base mounted by four ⅞-in. diameter anchor bolts imbedded in a 60-in. deep reinforced concrete foundation. The backbone of the shelter consists of a curved 8-ft. long, 12-in., aluminum extrusion I-beam, cut diagonally from flange to flange. The shelter is fabricated completely of aluminum and has all welded joints with the exception of the roof fasteners. The curved, cantilevered roof, which is 12 ft. wide and 10 ft. deep, is constructed of four-inch rib aluminum sheet attached to the main member with self-tapping cap screws. A 10-ft. long aluminum bench is centrally attached to the main member and has the quality of a linear contour chair.

The entire structure is lighted with an eight-ft. long fluorescent tube operated by a time clock. The light is directed to shine along the under side of the roof; however, a slit is provided on the bottom of the light case to light a specially designed bus schedule and map encased in a plastic holder. The center of gravity of the entire structure, which weighs only 470 lbs., is directly above the base plate. This shelter, which was fabricated by Apex Steel Corp., from Reynolds aluminum, cost the City approximately $1,300 delivered, and took approximately four man-days to install complete with electrification. Installation was made by Public Works personnel.

The design is one of a group of 80 submitted by architectural students from the USC School of Architecture in a contest sponsored by the City of Beverly Hills in 1958. The first, second and third place models received award prizes and three others were given honorable mention.

The Council ultimately selected one of the top designs for construction on the basis of appearance, economy of construction, utility, durability, economy of maintenance and adaptability to diverse locations. It is simple and light, yet very durable and sturdy. It is economical to maintain and will require very little expenditure for upkeep. It is flexible in its application in that it may be used at practically any bus stop location including those allowing very little space. Because of its single support and open-type construction, it does not obstruct the line of sight at street intersections and corners. Its acceptance, so far, has been very gratifying and the shelter has received constant use since its installation. Although the method of financing the installation of any additional shelters has not been determined, other than the obvious method of financing from the general fund, there are some interesting possibilities such as encouraging local service and civic groups to sponsor shelters with a plaque appropriately designating and giving credit to the sponsoring agency.

The local transit companies have taken a great interest in this shelter and have cooperated fully in development of special bus stop schedules and maps in addition to providing considerable assistance in public relations.

● **ATTRACTIVE shelter for bus patrons in Beverly Hills, California, is fabricated entirely of aluminum and weighs only 470 pounds. Installed as a pilot study to determine its practicality, the acceptance by the public has been most gratifying.**

Reinforced Concrete Pipe Chosen For

This 96" diameter reinforced concrete pipe easily met the rigid requirements of ASTM Specification C76-57T. Tests indicated this reinforced concrete pipe was capable of loads exceeding 100,000 pounds, demonstrating the strength and durability.

S. J. Groves and Sons Company, Minneapolis, Minnesota—
General Contractor
Abbott Contractors, Chicago, Illinois—Sub-Contractors
Waukesha Cement Tile Company, Milwaukee, Wisconsin—Pipe Suppliers
American Vitrified Products Company, Milwaukee, Wisconsin—
Pipe Suppliers
Lock-Joint Pipe Company, South Beloit, Illinois—Pipe Suppliers

Richard I. Bong Air Force Base Runway Drainage

More than 48,000 linear feet of concrete pipe was included in the Corps of Engineers specifications for the Richard I. Bong Air Force Base at Kansasville, Wisconsin. Many sizes were required, the largest being 96″ inside diameter. All reinforced concrete pipe was manufactured and pre-tested to meet the rigid requirements of ASTM Specification C76-57T. The 96″ pipe was required to meet a loading test of 96,000 pounds. It met this requirement easily and could have withstood loads exceeding 100,000 pounds!

Reinforced concrete pipe is designed in conformance with specifications comprehending the laws of mechanics plus the results of thousands of tests; it is manufactured by men experienced with concrete product production; and it is pre-tested to demonstrate its strength. The pre-testing is done by means of the 3-edge bearing test which is the most severe loading to which the pipe will ever be subjected!

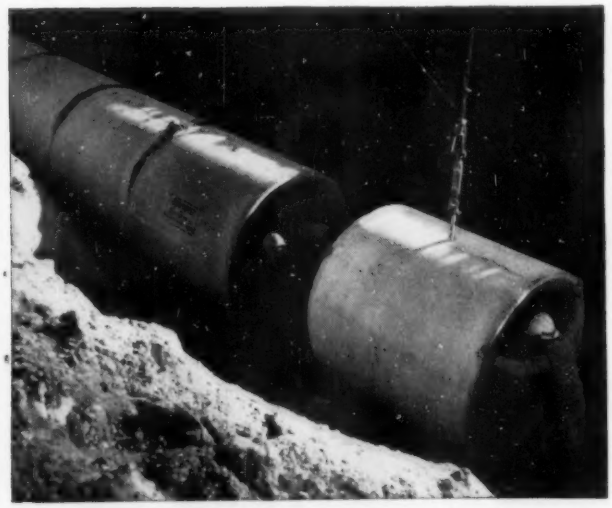
Reinforced concrete pipe installations, in service for many years, are testimony to the strength, durability and watertightness of concrete pipe reinforced with Welded Wire Fabric.

Concrete pipe manufacturers insist on top-quality reinforcing, meeting rigid specifications—that's why so many of them use American Welded Wire Fabric. This quality product, with its machine-made accuracy, assures the proper distribution of steel. It is prefabricated from cold-drawn, 60,000 psi yield strength wires. All intersections are electrically welded to assure mechanical anchorage in the concrete. Wire diameters as large as 0.505″ on 2″, 3″ or 4″ centers can be furnished. Its rigid specifications assure superior reinforcement.

Write American Steel & Wire, Dept. 9247, 614 Superior Avenue, N.W., Cleveland 13, Ohio for complete technical literature. *USS and American are registered trademarks*

American Steel & Wire Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors
United States Steel Export Company, Distributors Abroad



Sections of concrete pipe go in place more quickly and with no job interruptions. Its uniform size insures tight joints and proper alignment.

USS American Welded Wire Fabric, with its small diameter, closely spaced steel members, distributes load stresses evenly throughout the concrete pipe. It is the ideal concrete pipe reinforcement, easily formed to proper cage diameters.

American Welded Wire Fabric

TRAFFIC ENGINEERING in Tomorrow's Transportation

D. GRANT MICKLE,
Director, Traffic Engineering Div., Automotive Safety Foundation, Washington, D. C.

This is part of the paper presented in response to the 1958 Theodore M. Matson Memorial Award given to Mr. Mickle at the 28th Annual Meeting of the Institute of Traffic Engineers, at Miami Beach, Florida.

IT IS the responsibility of the traffic engineer to supply accurate information on traffic volume and travel desires, so as to insure adequate capacity, proper placement of interchanges and the most desirable highway locations for maximum service. He must forecast trends and project future traffic demands. He must predict motorists' habits and evaluate driving characteristics. He must assess the needs of motorists for services. Most of this information is passed on to the locating and design engineers, but when the new facility is completed the traffic engineer must be prepared to take it over and operate it efficiently and safely to the maximum advantage of the users.

Because modern controlled access roads and streets eliminate or obscure the usual landmarks and because generally higher operating speeds demand faster decisions, the guidance and direction of traffic becomes more complicated while at the same time requiring far more precision.

Present standards do not contemplate the location of service areas within the rights-of-way of the Interstate highway network. A means of adequately advising motorists about availability of food, lodging, fuel and repairs must be developed. It is up to the operations official to devise ways to communicate such information.

The marvels of electronics offer great potential for making driving on modern expressways safer and more relaxing. Application of these techniques to vehicle signals and controls to aid the driver and as traffic control devices to facilitate the traffic flow are areas wide open for exploration by both the traffic engineer and the vehicle designer.

Another area of major challenge is in making the existing highway transportation plant operate more efficiently.

The traffic engineer knows that much can be done to raise the service and safety level of existing streets. He needs public support and understanding to back him up on his proposals to create more one-way streets, eliminate curb parking or invest sufficient funds for modern traffic control systems.

Electronics open up new frontiers in this area, too. There are real opportunities to improve and devise control systems that measure densities, relate them to capacity and automatically adjust signal timing or route traffic for optimum street use. Television surveillance of the system to pinpoint accidents or detect congestion so that prompt action can be taken is another device being tested. Parking structures integrated with expressways and interchanges, with automatic guidance to available spaces are entirely feasible. Improvement of mass transit service

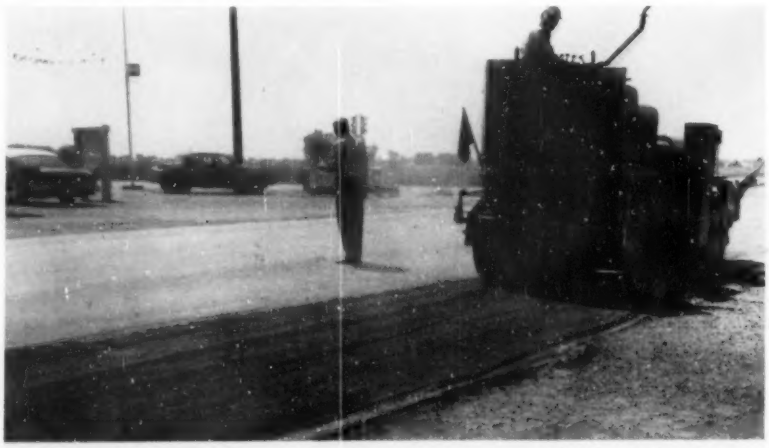
(*Please turn to page* 218)

Repaver Irons Out Road Wrinkles

MANY thousands of miles of rigid pavements on older streets and highways have been resurfaced with hot mix bituminous concrete, which adds years of service to the surface at a relatively low cost. However, under certain conditions of heat and traffic action, the surface may be deformed to produce troughs, ridges and corrugations.

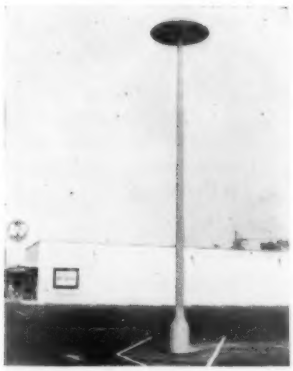
The Cutler Repaver is designed to level off, iron out and remold the asphalt resurfacing back to its original form, making full use of the existing asphalt material and without damaging the properties of the original hot mix. This machine performs four operations: 1) Heating is accomplished by using five air atomized fuel oil burners operating inside of a refractory lined chamber and firing through a heated grid roll which distributes the heat and transmits it to the pavement. 2) The heated pavement is leveled and thoroughly mixed by a hydraulically controlled grader blade which follows directly behind the heating chamber. This blade shaves off the high spots and deposits the excess material in the depressions. 3) The heated, leveled surface is compacted by heated rollers which both compact the material and heat the entire area. The Repaver is designed to operate back and forth over a defective area until it has accomplished complete restoration of the road surface. 4) Excess hot mix shaved from the high spots is picked up in a heated storage bin and retained there for filling holes and depressions in the roadway.

In addition to the repair of roads and streets that require immediate attention the low operating cost of the machine makes it useful for preventive maintenance. The operations can be carried out at a rate of 200-300 square yards per hour.



● **A TYPICAL AREA after ridges and bulges were removed by the Cutler Repaver.**

HY-LITE *Prestressed* concrete standards....



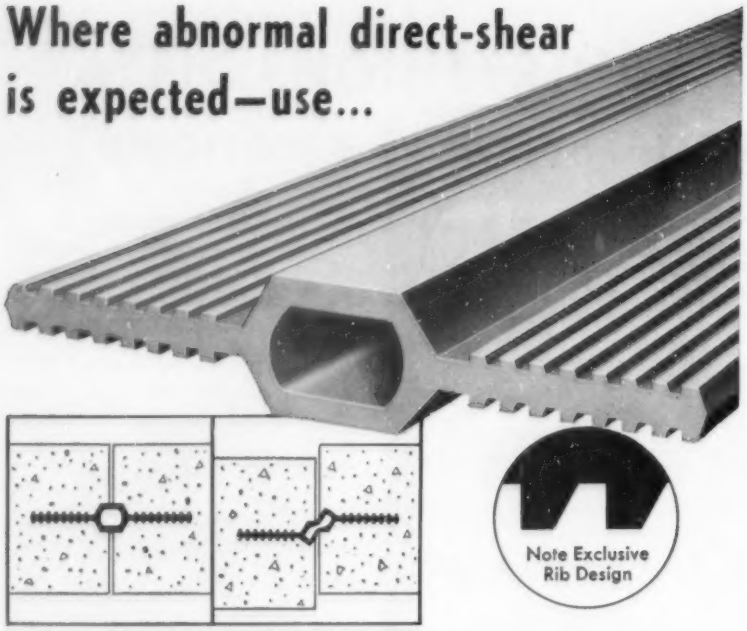
- finest appearance • lowest maintenance
- longest life...for every lighting need

• Catalog No. 400 offers complete information. Write for your copy today. Address the American Concrete Corporation, 5092 North Kimberly Avenue, Chicago 30, Illinois.

American Concrete

STRESS-SPUN CONCRETE LIGHTING STANDARDS

Where abnormal direct-shear is expected—use...



Type No. 6DS waterstops will effectively handle a ⅜" direct-shear in either direction.

SEALTIGHT® TYPE NO. 6DS PVC (POLYVINYLCHLORIDE) WATERSTOPS

When installing waterstops in concrete structures some modified shear at the joints is to be expected. The regular "Sealtight" PVC Diaphragm Waterstops will easily handle these modified shear movements. However, in many types of construction, such as circular concrete structures, greater direct-shear movements will normally occur. Type No. 6DS waterstops were specifically designed to provide a waterstop that would function effectively under abnormal direct-shear movement. The unique cross-section design permits type 6DS waterstops to successfully handle direct-shear movements of ⅜" in either direction. "Sealtight" PVC waterstops are manufactured to meet or exceed the following specifications; Specific Gravity ... 1.30 Max.: Durometer Hardness ... 80 ± 3; Tensil ... 2500 PSI Min.; Elongation ... 350% Min.; Cold Brittleness Test ... —35°F ASTM D746-SST. Chemically resistant to chlorinated water, salt water, acids, alkalies, sewage wastes, oil, etc.

ALSO AVAILABLE ...

"Sealtight" PVC Waterstops are available in a wide range of types and sizes ... widths from 3¾" to 9". There's a type and size to meet specific job requirements. Shipped in 50 ft. coils. Easy to install ... quickly spliced on the job without special skill or equipment. Write today for complete information ... request Bulletin No. 70.

OTHER SEALTIGHT® PRODUCTS

- "PREMOULDED MEMBRANE," the industry's only TRUE VAPOR SEAL.
- "CORKTITE" Perimeter Insulation
- "HYDROMAT" Asphalt Liners
- Expansion Joints of all types, including Asphalt, Fibre, Cork and Sponge Rubber.
- Joint Sealing Compounds
- Concrete Curing Compounds
- Air Entraining Agents

W. R. MEADOWS, INC.
25 KIMBALL ST. • ELGIN, ILLINOIS

based on imaginative concepts of service and equipment certainly merits professional attention.

All of these things require a bold approach and will cost money. Yet, if we demonstrate their feasibility and worth, the public will accept the cost in return for improved transportation service.

A third area of challenge is research. We need to know more about why people choose various forms of transportation. What is the relationship between the economic base of a community, its social and cultural activities and the kind and extent of its transportation requirements? What is the practicable and desired ratio of mass transportation service and individual transportation? How can we develop and use electronic computers and simulators to pre-test various traffic system concepts and control schemes? What is the proper ratio of mileage of expressways, arterials and parking spaces for various sized cities?

The search for more knowledge should be never-ending. To expand this endeavor, closer working relations might well be developed between universities and public officials, to the benefit of both. Researchers on university campuses working with students and/or field staffs of city or state traffic agencies could gain useful practical experience while making significant contributions to the fund of knowledge. Conversely, the public official would gain valuable new findings and his staff's knowledge and interest would be broadened from the research experience of the university people. Similar cooperative research can be carried on through joint efforts of automotive industry researchers and traffic operational specialists.

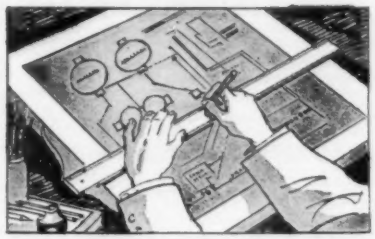
Administration

The administrative structure must recognize and embrace all elements of modern highway transportation management and provide for the smooth teamwork of all essential functions. The traffic engineer is one member of the team.

The basic functions of transportation management can be expressed in six or seven general categories: 1) Planning, 2) design, 3) construction, 4) operations, 5) maintenance, 6) inventory and records, and in cities 7) public transportation. In some of these the traffic engineer has major responsibility; in others his role may be only advisory.

Planning includes the collection and analysis of data to evaluate transportation service now being provided and to determine deficien-

CONSULTING ENGINEERS



CITY, COUNTY AND STATE

Mr. Consulting Engineer . . .
Increase your sales power to the growing public works field by including your professional card in our DIRECTORY OF CONSULTING ENGINEERS. *For rates in this section write to:*
Public Works Magazine
200 So. Broad St. Ridgewood, New Jersey

TOPOGRAPHIC • PLANIMETRIC • MOSAIC MAPS

ALSTER & ASSOCIATES, INC.
ENGINEERS
cuts your mapping costs
Write for free brochure on mapping and aerial photography.
6135 Kansas Ave., N.E., Washington 11, D.C. TA 9-1167

Brockway, Weber & Brockway
Engineers, Incorporated
George S. Brockway — Roy E. Weber — George R. Brockway
Staff
H. L. Fitzgerald — Ben E. Whittington — Robert E. Owen
Ernest L. Greene — Thomas A. Clark — Thomas R. Demery — Charles A. Anderson
Civil, Structural, Sanitary, Municipal, Electrical, Land Planning
West Palm Beach, Florida — Ft. Pierce, Florida

GIBBS AND HILL, INC.
Consulting Engineers

Industrial Wastes Water & Sewage Works Hydraulic Developments	Electric Transmission & Distribution Systems Conventional & Nuclear Power Generation Power Surveys & Contracts	Airports Rapid Transit Highways & Bridges
Los Angeles 14, Calif. 510 W. 6th St.	NEW YORK 1, N.Y. Pennsylvania Station	Tampa, Fla. 608 Tampa St.

PALMER AND BAKER ENGINEERS, INC.
CONSULTING ENGINEERS — ARCHITECTS
Surveys-Reports-Design-Supervision-Consultation
Transportation and Traffic Problems
Tunnels-Bridges-Highways-Airports-Industrial Buildings
Waterfront and Harbor Structures, Graving and Floating Dry Docks
Complete Soils, Materials and Chemical Laboratories
Mobile, Ala. — New Orleans, La. — Washington, D.C.

ROBERT AND COMPANY ASSOCIATES
Municipal Engineering Division
ATLANTA
WATER SUPPLY, SEWAGE DISPOSAL, INCINERATORS, POWER PLANTS

Abrams Aerial Survey Corporation
Photogrammetric Services
AERIAL PHOTOGRAPHY,
TOPOGRAPHIC MAPS,
ATLAS SHEETS AND MOSAICS
IVanhoe 4-9441 — Lansing, Michigan

AERO SERVICE CORPORATION
Aerial topographic maps—photo-maps for engineering projects anywhere in the world—highways, railroads, cities, power and pipe lines, mining development. Soil studies and electronic surveys of large areas; resources inventories.
210 E. Courtland — Philadelphia 20

AIRWAYS ENGINEERING CORP.
Airports, Highways, Dams, Fuel Storage,
Pipe Lines, Harbor Developments
1212—18th St., N.W. — Washington 6, D.C.
Phone: REpublic 7-8131

ALBRIGHT & FRIEL INC.
Consulting Engineers
Water, Sewage, Industrial Wastes and Incineration Problems
City Planning Highways, Bridges and Airports
Dams, Flood Control, Industrial Buildings
Investigations, Reports, Appraisals and Rates
THREE PENN CENTER PLAZA
PHILADELPHIA 2, PENNSYLVANIA

ALVORD, BURDICK & HOWSON
Engineers
Water Works, Water Purification, Flood Relief, Sewage, Sewage Disposal, Drainage, Appraisals, Power Generation
20 No. Wacker Dr. — Chicago 6, Ill.

AMERICAN AIR SURVEYS INC.

Aerial Topographic Maps
Aerial Photos & Mosaics
for
• municipal planning & engineering
• pipe lines • roads, airports • tax maps
967 Penn Ave., Pittsburgh 22, Pa.
Reps.—Chicago-Huntington, W. Va.
A Nationwide Service

MICHAEL BAKER, JR., INC.
THE Baker Engineers
Civil Engineers, Planners, and Surveyors
Airports, Highways, Sewage Disposal Systems,
Water Works Design and Operation—
City Planning—Municipal Engineering—
All types of Surveys
Home Office: Rochester, Pa.
Branch Offices:
Jackson, Miss. — Harrisburg, Pa.

BARNARD AND BURK
Consulting Engineers
Municipal and Industrial Engineering Surveys, Reports, Waterworks, Sewerage and Sewage Disposal, Revenue Projects, Natural Gas, Light and Power, Streets and Highways, Harbor and Port Developments
1023 Nicholson Drive
Baton Rouge, Louisiana

CARL BUSSOW
Consulting Chemist and
Paving Engineer
Specialist on
Asphalt Petroleum and
Tar Products
801 Second Ave. — New York 17, N.Y.

BANISTER ENGINEERING CO.
Consulting Engineers
"Staffed to completely fill municipal requirements for professional service"
310 No. Snelling Ave. Tel. Midway 6-2612
St. Paul 4, Minnesota

FOR RATES FOR THIS SPACE
write
PUBLIC WORKS MAGAZINE
200 So. Broad St. Ridgewood, N.J.

E. D. BARSTOW & ASSOCIATES
Engineers
Water Supply, Treatment, Distribution
Sewage Collection, Treatment, Disposal
Trade Waste Treatment
163 N. Union St. Akron 4, Ohio

FOR RATES FOR THIS SPACE
Write
PUBLIC WORKS MAGAZINE
200 So. Broad St., Ridgewood, N.J.

LAWRENCE T. BECK AND ASSOCIATES
Engineers and Consultants
Philadelphia New York Washington

HOWARD K. BELL
Consulting Engineers
G. S. Bell C. G. Gaither J. K. Latham
J. W. Finney, Jr.
Water Works Sewage Disposal
Water Purification Sewerage
Swimming Pools Refuse Disposal
Industrial Wastes
553 S. Limestone St. Lexington, Ky.

BLACK & VEATCH
Consulting Engineers
Water—Sewage—Electricity—Industry
Reports, Design, Supervision of Construction
Investigations, Valuations and Rates
1500 Meadow Lake Pkwy., Kansas City 14, Mo.

CLINTON BOGERT ENGINEERS
Consultants
Clinton L. Bogert Ivan L. Bogert
Donald M. Ditmars Robert A. Lincoln
Charles A. Manganaro William Martin
Water & Sewage Works Incinerators
Drainage Flood Control
Highways and Bridges Airfields
145 East 32nd Street, New York 16, N. Y.

BOWE, ALBERTSON & ASSOCIATES
Engineers
Sewage and Water Works
Industrial Wastes — Refuse
Disposal — Municipal Projects
Industrial Buildings — Reports
Plans — Specifications
Supervision of Construction
and Operation — Valuations
Laboratory Service
75 West Street, New York 6, N.Y.

BOYLE ENGINEERING
Architectural & Engineering Consultants
Water—Development, Treatment, Storage, Distribution, Sewage Collection, Sewage Treatment, Refuse.
Waste Disposal—Industrial, Commercial, Residential, Municipal, Highways, Streets, Bridges, Parks, Harbors, Flood Control, Special Districts, Civic, Industrial, Commercial Buildings, Structures, Site Planning.
Bakersfield Santa Ana San Diego
California

BROWN ENGINEERING CO.
Consulting Engineers
Waterworks, Sewage Disposal, Airports
Street Improvements, Power Plants
Electric Distribution, Rates
508 TENTH STREET DES MOINES 9, IOWA

BROWN AND CALDWELL
Civil and Chemical Engineers
Water — Sewage — Industrial Waste
Consultation — Design — Operation
Chemical and Bacteriological Laboratories
66 Mint Street San Francisco 3

Floyd G. Browne and Associates
Consulting Engineers
F. G. Browne S. W. Kuhrmeyer
W. G. Smiley G. M. Hinkamp
C. R. Martin W. H. Kuhn
Water Supply and Purification — Sewage and Industrial Waste Treatment — Refuse Disposal — Electric Systems — Surveys — Reports Valuation and Rates
Marion, Ohio

BUCK, SEIFERT AND JOST
Consulting Engineers
Water Supply Sewage Disposal
Hydraulic Developments
Reports, Investigations, Valuations
Rates, Design, Consultation, Operation
Management, Chemical and
Biological Laboratories
112 East 19th St. New York City

BURGESS & NIPLE
Consulting Engineers
Established 1908
Water supply, treatment and distribution
Sewage and industrial wastes disposal
Investigations, reports, appraisals, rates
Airports, Municipal Engineering, Supervision
2015 West Fifth Ave. Columbus 12, Ohio

RALPH H. BURKE, INC.
Consulting Engineers
Traffic Studies Underground Garages
Parking Structures Grade Separations
Expressways, Airports and Terminal Buildings
Shore Protection Municipal Engineering
Parks Field Houses Swimming Pools
20 North Wacker Drive, Chicago 6, Ill.

BURNS & McDONNELL
Engineers - Architects - Consultants
4600 E. 63rd ST., TRAFFICWAY
KANSAS CITY 41, MISSOURI

FOR RATES FOR THIS SPACE
WRITE
PUBLIC WORKS MAGAZINE
200 So. Broad St., Ridgewood, N.J.

cies. It entails programming of transportation improvements and the determination of priorities. To be effective, it requires coordination and cooperation with the development of other physical improvements such as recreation and commercial centers, housing developments and parks. Planning provides the administrative head with advisory service on policy and makes it possible to keep tabs on progress of the various programs underway.

Design. The designer gives physical dimensions to the plans. He develops general standards and design criteria and prepares construction plans. His standards must reflect knowledge of driver and vehicle characteristics as well as physical properties of materials. Data from many sources, including information derived from the planning, operations, and survey functions, carried on by traffic engineers, are essential to the designer.

Construction gives physical reality to plans and designs and is closely related to design. This function may include actual construction or it may be limited to the supervision and inspection of contract work. This is not the traffic engineer's work, but he is obviously concerned as operations are affected.

Operations. The operation and control of streets or highways, so as to produce optimum transportation service with a minimum of accidents and inconvenience, is a major responsibility of the traffic engineer. This function embraces the preparation of operational plans and programs the development and use of traffic control devices, preparation of traffic and accident studies, control and regulation of parking and curb openings, traffic routing and issuance of permits for special uses that affect efficient or safe traffic flow. Obviously, there is close relationship between operation functions and those of planning and design.

Maintenance. The objective of maintenance is to keep the various components of the street or highway system in serviceable condition and to protect the public's investment in its roadway plant through regular inspection, preventive and corrective maintenance. Again, the traffic engineer is concerned, not directly, but rather as the level of maintenance affects operations.

Inventories and Records. Records of the physical dimensions and conditions of the roadway plant are a necessary part of street and highway management. Because of certain legal requirements, a record of the

CAMP, DRESSER & McKEE

Consulting Engineers

Water Works and Water Treatment
Sewerage and Sewage Treatment
Municipal and Industrial Wastes
Investigations and Reports
Design and Supervision
Research and Development
Flood Control

6 Beacon St. Boston 8, Mass.

Capitol Engineering Corporation

Consulting Engineers

Water Works — Sewage Systems
Design and Surveys — Roads and Streets
Planning — Airports
Bridges — Dams

Executive Offices: Dillsburg, Pa.

Dallas, Texas — Rochester, N.Y.
Pittsburgh — Washington
Saigon, Vietnam

JOHN A. CAROLLO

Consulting Engineers

Water Supply and Purification, Sewerage
Sewage Treatment, Power Generation and
Distribution, Gas Systems, Valuations

3308 N. Third St., Phoenix, Arizona
2168 Shattuck Ave., Berkeley 4, Calif.

THE CHESTER ENGINEERS

Water Supply and Purification
Sewage and Industrial Waste Treatment
Power Plants—Incineration—Gas Systems
Valuations—Rates—Management
Laboratory—City Planning

681 Suisman Street, Pittsburgh 12, Penna.

CHICAGO AERIAL SURVEY

PHOTOGRAMMETRIC ENGINEERS

Aerial photography since 1923. Complete photogrammetric services for city, county, highway and consulting engineers.
Developers of Sonne Strip Photography
• Base maps and atlas sheets • Precise topographic maps for sewerage studies, construction planning and site location. • Scaled mosaics and pictorial presentations • Highway studies. Street and road maps. Sonne photography.
10265 FRANKLIN AVE., FRANKLIN PARK, ILL.
A Division of Chicago Aerial Industries, Inc.

CLARK & GROFF ENGINEERS

Consulting Engineers

Civil, Sanitary & Municipal Engineering
Investigations, Reports, Plans
Supervision of Construction
Laboratory

3240 Triangle Dr. Salem, Oregon

CHAS. W. COLE & SON

Engineers—Architects

3690 E. Jefferson Blvd. — 2112 W. Jefferson St.
South Bend, Indiana — Joliet, Illinois

CONSOER, TOWNSEND & ASSOC.
—CONSULTING ENGINEERS—

Sewage treatment, sewers, storm drainage, flood control—Water supply and treatment—Highway and bridges—Airports—Urban renewal—Electric and gas transmission lines—Rate studies, surveys and valuations—Industrial and institutional buildings.

360 EAST GRAND AVENUE
CHICAGO 11, ILLINOIS

CRAWFORD, MURPHY & TILLY

Consulting Engineers

Water Works—Impounding Reservoirs
Highways—Municipal Streets—Expressways
Traffic Problems—Airports—Swimming Pools
Sewers—Sewage Treatment—Wastes Treatment
Storm Drainage—Flood Control—Surveys & Reports

755 So. Grand Ave., W. — Lakeside 8-5619
Springfield, Ill.

ALFRED CREW

Consulting Engineers

Water Supply, Treatment and Distribution
Sewerage and Sewage Disposal
Drainage and Industrial Wastes

45 N. Broad St. Ridgewood, N.J.

DANIEL, MANN, JOHNSON & MENDENHALL

Planning - Architecture - Engineering

Airports — Water Supply & Purification
Harbors — Sewage Treatment Plants
Rapid Transit — Storms Drains
Urban Renewal — Municipal Buildings
Traffic & Parking — Industrial & Commercial
Reports & Consultations — Buildings

3325 Wilshire Boulevard — 1145 19th Street, NW
Los Angeles, California — Washington, D.C.

DE LEUW, CATHER & COMPANY

Consulting Engineers

Public Transit — Subways
Traffic & Parking — Railroad Facilities
Expressways — Industrial Plants
Grade Separations — Municipal Works
Urban Renewal — Port Development

150 North Wacker Drive, Chicago 6
San Francisco — Toronto — Boston

H. G. DILL COMPANY

Consulting Engineers

H. G. Dill — J. A. Rousculp
G. W. Hockaden — B. W. Lipes

Civil, Sanitary, Structural, Municipal, Highway, Subdivision, Planning, Property Surveys, Topographic Surveys, Reports, Appraisals.

2607½ No. High St. — Columbus 2, Ohio
AM 2-9744

ROY B. EVERSON

Water Treatment Service Since 1900 for Swimming Pool Circulating Systems. Purification Systems as applied to Sewage Treatment and Water Works. A New System for Automatic Control.

237 W. Huron Street, Chicago 10, Ill.

FAY, SPOFFORD & THORNDIKE, INC.

Engineers

Airports — Bridges — Express Highways
Industrial Bldgs.—Incinerators—Port Developments
Water Supply — Drainage and Sewerage Systems
11 Beacon Street, Boston, Mass.

FINKBEINER, PETTIS & STROUT

Carleton S. Finkbeiner — Chas. E. Pettis
Harold K. Strout

Consulting Engineers

Reports — Designs — Supervision
Water Supply, Water Treatment, Sewerage, Sewage Treatment, Wastes Treatment, Valuations & Appraisals

2130 Madison Avenue — Toledo 4, Ohio

WALTER H. FLOOD & CO.

Chemical Engineers

Inspection and Testing of Materials and Structures
Streets — Roads — Airports
Building and General Engineering Construction
Resident Inspection — Chemical & Physical Tests
Soil Boring & Investigation—Concrete Core Cutting
Specifications — Reports — Research

6102 S. Blackstone Ave. Chicago 37, Ill.

FRIDY, GAUKER, TRUSCOTT & FRIDY, INC.

Engineers

Hospitals, Schools, Industrial Buildings, Public Buildings, Airports, Roads, Water, Sewage, Petroleum Facilities, Waste Disposal, Power & Lighting, Reports, Plans, Supervision, Appraisals.

1321 Arch Street — Philadelphia 7, Penna.

GRAY and OSBORNE

Consulting Engineers

Specializing In
Municipal Utilities — Design
Feasibility — Valuations — Rate
Studies — Master Planning

228 South 2nd St. Yakima, Washington

FOR RATES FOR THIS SPACE

WRITE

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

GILBERT ASSOCIATES, Inc.

Engineers and Consultants

Power Plant Engineering
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service

New York — READING, PA. — Washington

FOR RATES FOR THIS SPACE

WRITE

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

GREELEY & HANSEN

Engineers

Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal

14 East Jackson Blvd., Chicago 4, Illinois

HOWARD R. GREEN CO.

Consulting Engineers

DESIGN AND SUPERVISION OF MUNICIPAL DEVELOPMENTS
Water Works and Treatment—Sewers and Sewage Disposal—Investigations and Valuations

208-10 Bever Bldg., Cedar Rapids, Iowa
Established 1913

WILLIAM F. GUYTON AND ASSOCIATES

Consulting Ground-Water Hydrologists

Underground Water Supplies
Investigations, Reports, Advice

307 W. 12th St., Austin 1, Texas
Phone: GR 7-7165

HARDESTY & HANOVER

Consulting Engineers

Long Span and Movable Bridges, Hanover Skew Bascule, Grade Eliminations, Foundations, Expressways and Thruways, Other Structures, Supervision, Appraisals, and Reports

101 Park Avenue, New York 17, N.Y.

HAVENS AND EMERSON

A. A. Burger — H. H. Moseley
J. W. Avery — F. S. Palocsay
E. S. Ordway — G. H. Abplanalp
A. M. Mack — S. H. Sutton
Frank C. Tolles, Consultant

Consulting Engineers

Water, Sewerage, Garbage, Industrial Wastes, Valuations—Laboratories

Leader Bldg. — Woolworth Bldg.
Cleveland 14, O. — New York 7, N.Y.

HAZEN AND SAWYER
Engineers
Water and Sewage Works
Industrial Waste Disposal
Drainage and Flood Control
Reports, Design, Supervision
of Construction and Operation
Appraisals and Rates
122 East 42nd St. — New York 17, N.Y.
2333 Book Tower — Detroit 26, Mich.

HENNINGSON, DURHAM & RICHARDSON, INC.
Consulting Engineers
Consulting Engineers since 1917 for
more than 700 cities and towns.
Water Works, Light and Power, Sewerage,
Paving, Airports, Reports,
Appraisals, Drainage
2962 Harney St. — Omaha 2, Nebr.

HILL & HILL
Engineers
Sewage and Waste Disposal,
Water Supply and Filtration,
Dams, Reservoirs, Tunnels,
Airport and Topographic Surveys
Home Office: 8 Gibson St., North East, Pa.

HAROLD HOSKINS & ASSOCIATES
Consulting Engineers
Sewers and Sewage Treatment
Paving — Water Supply — Drainage
Bridges — Airports — Reports
Aerial Photogrammetry
Power Plants — Surveys
1628 Que St., Lincoln 8, Nebr.
1018 Eight Avenue, Greeley, Colorado

MARK HURD AERIAL SURVEYS, INC.
Topographic And Planimetric Maps
Tax Maps — Aerial Photography
230 Oak Grove Street Minneapolis 3, Minn.

Jenkins, Merchant & Nankivil
Consulting Engineers
Municipal Improvements — Gas Systems
Highways & Airports — Water Systems
Power Development — Sewerage Systems
Traffic Surveys — Industrial Plants
Flood Control — Recreational Facilities
Investigations and Reports
801-805 East Miller St., Springfield, Ill.

JOHNSON DEPP & QUISENBERRY Inc.
Consulting Engineers
Highways — Water Supply
Airports — Sewage Disposal
Planning — Surveys
915 Frederica St. — Owensboro, Ky.

JOHNSON SOILS ENGINEERING LABORATORY
Laboratory and Field Testing
Shear and Consolidation Tests
Design and Construction Control
MOBILE LABORATORIES
193 West Shore Avenue
Bogota, New Jersey

JONES HENRY & WILLIAMS
Consulting Sanitary Engineers
Water Works
Sewerage and Treatment
Waste Disposal
Security Bldg. — Toledo 4, Ohio

EDWARD C. JORDAN CO., INC.
Civil & Sanitary Engineers
Sewerage • Sewage Disposal • Industrial Wastes
Drainage • Water Supply • Streets • Highways
Municipal Engineering
Investigations—Reports—Designs—Supervision
379½ Congress St., Portland, Maine
Tel. SP. 4-6315

KENNEDY ENGINEERS
Complete Public Works Engineering
- Water Supply
- Sewage and Waste Treatment
- Sewage Reclamation
- Utilities Planning

CHEMICAL and BIOLOGICAL LABORATORY
SAN FRANCISCO
Los Angeles — Tacoma — Salt Lake City

KEIS & HOLROYD
Consulting Engineers
(Formerly Solomon & Keis)
Since 1906
Water Supply, Sewage Disposal, Garbage &
Refuse Incineration, Industrial Buildings
Troy, N.Y.

FENTON G. KEYES ASSOCIATES
Consulting
ARCHITECT—ENGINEERS
Providence 3, R.I. — Waltham 54, Mass.

KING & GAVARIS
Consulting Engineers
Bridges — Highways — Toll Roads
Arterials — Foundations
Reports — Investigations — Surveys
Supervision of Construction
425 Lexington Ave. — New York

MORRIS KNOWLES INC.
Engineers
Water Supply and Purification, Sewage
and Sewerage Disposal, Industrial Waste,
Valuations, Laboratory, City Planning
1312 Park Building, Pittsburgh 22, Pa.

DANIEL KOFFLER AND ASSOCIATES
Consulting Engineers
Structural, mechanical and sanitary engineering.
Bridges, special structures, cold storage ware-
housing, industrial developments, parking garages
and airplane hangars.
Dupont Blvd. and Washington Ave.
New Castle, Del.

LADD ENGINEERING CO.
Consulting Engineers
Sewers, Water, Paving,
Filter Plants, Disposal Plants,
Electric Systems
Southeastern States
Home Office: FORT PAYNE, ALA.

FOR RATES FOR THIS SPACE
write
PUBLIC WORKS MAGAZINE
200 So. Broad St. — Ridgewood, N.J.

location and condition of traffic control devices must be kept up-to-date. Maps, survey notes, and other data are all essential to an adequate fulfillment of this function.

Public Transportation. Recognizing that the public interest is best served when all elements of the city's transportation program are reasonably balanced and coordinated, the community must develop sound policies on public transportation. Such policies can be formulated only on the basis of pertinent data assembled through competent, long-range planning by traffic management. Akin to this are the regulatory functions, such as granting of permits to operate public vehicles and the establishment of rules for the use of city streets. Increasingly, this task is falling to the traffic engineer as the best-qualified member of the transportation management team.

By and large, the quality of traffic engineering performance will depend, first, on whether his operation functions are properly positioned in the general structure of government; and second, whether they are properly keyed to the other aspects of street or highway transportation management.

The relate these functions effectively within a complicated governmental organization, we need guideposts to chart our actions. Detailed studies of numerous state and city traffic engineering organizations have been conducted, and these have made an outstanding contribution in that they have developed such guideposts in the form of basic criteria of good organization. Briefly, these are:

1. Related functions should be consolidated so that each unit of the organization is made responsible for a logical, clearly defined, separable function or group of functions.

2. Interdependent functions should be assigned to units reporting to the same supervisor at the next higher level of authority.

3. Each essential function should be assigned definitely to a single unit and accomplished by a single chain of command and accountability.

4. The rank of each unit should be based on the relative importance of its functions.

5. Each unit should have sufficient authority and resources to carry out its assigned responsibilities and should be required to make, and stand accountable for, all decisions within the scope of its designated authority.

6. The distinction between policy and technical decisions should be

kept clear and each decision should be executed at its proper level.

7. Objective, duties, scope of responsibility, and limits of authority of each unit should be stated plainly in writing and accepted universally throughout the organization.

At the state level the consolidation of functions within a single purpose highway department is the rule. The traffic engineer is making his contribution. Does he, however, have adequate authority, clearly stated, to carry out the operational functions. Clear assignment of the operational responsibilities and definition of traffic engineering functions are clearly called for. In recognition of these new conditions a special committee for the Traffic Committee of AASHO is about to report on three years of study on the functions and administration of traffic engineering in the state highway departments.

In urban areas at present, the role of the traffic engineer may vary from that of advisory in the Police Department to cabinet officer under the Mayor or City Manager. Logic would seem to dictate that if the criteria and functions just described are to be effectively carried out, the traffic engineer's functions should be consolidated with related activities in a Department of Street Transportation. With the creation of such a Department in city government, proper coordination of all street and traffic functions can be effected on a permanent basis. This approach also affords the traffic engineer the opportunity to move into broader fields of endeavor and not become confined to a narrow groove characterized by signs, signals and markings. The traffic engineer can be vastly more effective in urban transportation planning and design than is now typical.

Our opportunity lies in the contribution we can make through the use of traffic engineering knowledge to: (1) improve highway design and planning, (2) increase traffic efficiency and safety, (3) integrate transportation planning and urban development, and (4) correlate street transportation, public transit and parking.

To meet these responsibilities and take full advantage of the opportunities we must broaden the training of both highway and traffic engineers. More engineering colleges will have to add traffic engineering courses to their highway engineering curriculums if the growing demand for fully-trained highway transportation specialists is to be met.

THE LOZIER COMPANY
Consulting Sanitary Engineers
Sewerage, Sewage Disposal, Water Supply, Water Purification, Refuse Disposal
10 Gibbs Street — Rochester 4, N.Y.

FOR RATES FOR THIS SPACE
WRITE
PUBLIC WORKS MAGAZINE
200 So. Broad St., Ridgewood, N.J.

EMMET J. McDONALD & ASSOCIATES
CONSULTING ENGINEERS
HIGHWAYS, MUNICIPAL, SURVEYS
ELECTRONIC COMPUTATIONS
55 E. Cuyahoga Falls Ave. — Akron 10, Ohio

GEORGE B. MEBUS, INC.
Consulting Engineers
Sewerage — Industrial Wastes
Water Supply — City Planning
Investigations and Reports
Design and Supervision of Construction
Valuations
Broad Street Trust Co., Bldg.
Glenside, Pa.

MERRITT & WELKER
Engineers
Water, Sewage, Streets, Roads, Natural Gas, Valuations, Municipal Planning
208 Roswell Street — Marietta, Georgia

METCALF & EDDY
Engineers
Water, Sewage, Drainage, Refuse and Industrial Wastes Problems
Airports — Valuations
Laboratory
Statler Building
Boston 16

MORAN, PROCTOR, MUESER & RUTLEDGE
Consulting Engineers
Foundations for Buildings, Bridges and Dams; Tunnels, Bulkheads, Marine Structures; Soil Studies and Tests, Reports, Design and Supervision
415 Madison Ave. — New York 17, N.Y.
Eldorado 5-4800

GEORGE V. R. MULLIGAN, P.E.
Management Consultant
Operation Analysis
Manpower Utilization
Management Controls
601-19th Street, N.W. — Washington, D.C.

NUSSBAUMER-CLARKE and VELZY
Consulting Engineers
Sewage Treatment—Water Supply
Incineration—Drainage—Highway Planning
Appraisals and Rate Studies
327 Franklin St., Buffalo 2, N.Y.
369—5th Ave., New York 36, N.Y.

O'BRIEN & GERE
Consulting Engineers
Water Supply, Treatment, and Distribution
Sewerage and Sewage Treatment
Industrial Waste Treatment—Flood Control and Drainage
Rate Studies—Development Planning—Surveys
400 East Genesee Street — Syracuse 2, N.Y.

PARSONS, BRINCKERHOFF HALL & MACDONALD
Civil and Sanitary Engineers
Water, Sewage, Drainage and Industrial Waste Problems.
Structures—Power—Transportation
165 Broadway — New York 6, N.Y.

FOR RATES FOR THIS SPACE
Write
PUBLIC WORKS MAGAZINE
200 So. Broad St., Ridgewood, N.J.

MALCOLM PIRNIE ENGINEERS
Civil & Sanitary Engineers
Malcolm Pirnie — Ernest W. Whitlock
Robert D. Mitchell — Carl A. Arenander
Malcolm Pirnie, Jr.
Investigations Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates
25 W. 43rd St. — New York 18, N.Y.

THE PITOMETER ASSOCIATES, INC.
Engineers
Water Waste Surveys
Trunk Main Surveys
Water Distribution Studies
Water Measurement and Special Hydraulic Investigations
50 Church St., New York City

PRAEGER-KAVANAGH
Engineers
128 E. 38th St. — New York 16, N.Y.

HAROLD S. PRESCOTT
Consulting Engineers
Water Supply & Treatment Plants.
Sewerage & Sewage Disposal; Industrial Wastes; Investigation & Reports; Design; Supervision of Construction & Operation; Municipal Consultants.
594 Main Street — Placerville, California

RADER AND ASSOCIATES
Engineers—Architects
Water Works, Sewers, Sewage Disposal and other Public Works Projects, Hotels, Office, Industrial and Commercial Buildings
Plans, Specifications, Supervision, Reports
Investigations, Consultations
Aerial Photography, Photogrammetry
The First National Bank Bldg., Miami 32, Florida
Phone FRanklin 1-3351

ROY EDWIN RAMSEIER AND ASSOCIATES
Sanitary and Hydraulic Engineers
Water Supply, Treatment, Distribution
Sewerage and Sewage Treatment
Chemical and Bacteriological Laboratories
1519 Solano Avenue, Berkeley 7, California

DALE H. REA

Consulting Engineers

Water Supply and Treatment Sewage Collection and Treatment Irrigation, Reservoirs and Dams, Airports, Buildings and Bridges
Appraisals — Reports — Specifications
Supervision of Construction

2200 West Chenango — Littleton, Colorado
PY. 4-2546

RIPPLE AND HOWE, Inc.

Consulting Engineers

APPRAISALS AND REPORTS
DESIGN AND SUPERVISION

Water Works Systems, Filtration Plants, Irrigation and Drainage Systems, Reservoirs and Dams, Sanitary and Storm Sewer Systems, Sewage Treatment Plants, and Refuse Disposal.

O. J. Ripple — V. A. Vassen — B. V. Howe
833 23rd St. — Denver 5, Colo.

RUSSELL AND AXON

Consulting Engineers

Civil—Sanitary—Structural
Industrial—Electrical
Rate Investigations

408 Olive St., St. Louis 2, Mo.
Municipal Airport, Daytona Beach, Fla.

CARL SCHNEIDER

Consulting Engineers

Incineration — Sanitary Fills
Refuse Collection — Sanitation Studies
Reports

602 Pan American Bldg.
New Orleans 12, La.

IRBY SEAY COMPANY

Engineers—Consultants

Water Supply & Treatment — Natural Gas Systems
Sewage System & Treatment — Electrical

816 Goodwyn Inst. Bldg. — Phone JAckson 7-2932
Memphis, Tennessee

SEELYE STEVENSON VALUE & KNECHT

Consulting Engineers

Richard E. Dougherty, Consultant
Civil, Mechanical, Electrical

Airports, Highways, Bridges, Industrial Plants, Dams, Water Supply, Sanitation, Tunnels, Piers, Reinforced Concrete, Steel

101 Park Avenue — New York 17, N.Y.

SERVIS, VAN DOREN & HAZARD

Engineers-Architects

Investigations • Design • Supervision of Construction • Appraisals

Water • Sewage • Streets • Expressways • Highways • Bridges • Foundations • Airports • Flood Control • Drainage • Aerial Surveys • Site Planning • Urban Subdivisions • Industrial Facilities Electrical • Mechanical

2910 Topeka Blvd. — Topeka, Kansas

SMITH & GILLESPIE

Municipal and Consulting Engineers

Water Supply, Water Purification
Sewerage, Sewage Disposal, Drainage
Refuse Disposal, Gas Systems, Power Plants
Airports

Jacksonville — Florida

FOSTER D. SNELL, Inc.

29 West 15th St., New York 11, N.Y.
WAtkins 4-8800

Chemists, Engineers, Bacteriologists, Toxicologists, Market Research.
19 stories of laboratories with a staff of over 130.
YOUR INQUIRY ANSWERED PROMPTLY

SOIL TESTING SERVICES, INC.

Consulting Engineers

CARL A. METZ — JOHN P. GNAEDINGER

Soil Investigations
Foundation Recommendations and Design
Laboratory Testing

1827 No. Harlem Ave. — Chicago 35, Ill.
San Francisco — Milwaukee, Wis.
Havana, Cuba — Portland, Michigan

SPRAGUE & HENWOOD, INC.

Drilling Services

Foundation Investigations — Test Boring
Grout Hole Drilling and Pressure Grouting
Diamond Core Drilling

221 W. Olive St., Scranton, Pa.
New York, Philadelphia, Pittsburgh, Atlanta
Grand Junction, Colorado
Buchans, Newfoundland

STANLEY ENGINEERING COMPANY

Consulting Engineers

Hersey Building — Muscatine, Iowa
208 S. LaSalle St. — Chicago 4, Illinois
1154 Hanna Building — Cleveland 15, Ohio

ROBERT H. STELLWAGEN

Consulting Engineer

Municipal and Industrial Waste Problems
Collection, Incineration, Salvage, Pumping, Treatment, Testing

629 Buhl Bldg. — Detroit 26, Mich.

ALDEN E. STILSON & ASSOCIATES

Consulting Engineers

Water Supply, Sewerage, Industrial Waste
Bridges—Highways—Industrial Structures
Mechanical & Industrial Layouts & Studies
Land Use Planning & Industrial Parks

245 N. High St. — 75 Public Square
Columbus, Ohio — Cleveland, Ohio

SUHR, PETERSON, PETERSON & SUHR

Consulting Engineers

REPORTS—PLANS—SUPERVISION

Sewerage, Water Supply, Flood Control and Drainage Airports, Roads, Surveys, Fixed and Movable Bridges.

138 N. Wells St. — Chicago 6, Illinois

THOMPSON SURVEY SERVICE

Civil Engineer — Registered Surveyor

Land Subdivision
Construction and Topographic
Surveys and Municipal Engineering

JOHN M. THOMPSON
3987 Northern Pike, Monroeville, Penna.

UHLMANN ASSOCIATES

H. E. BONHAM — NYE GRANT
CARL E. KUCK — J. M. BRUNDAGE

Consulting Engineers

Sewage and Industrial Waste Treatment
Water Supply and Purification

4934-38 N. High St. — Columbus 14, Ohio

JOSEPH S. WARD

Consulting Soil and Foundation Engineer

Site Investigation, Boring Supervision, Laboratory Soil Testing, Foundation and Pavement Analysis and Design, Construction Supervision, Engineering Reports and Consultation.

91 Roseland Avenue — Caldwell, N.J.

J. STEPHEN WATKINS

J. S. Watkins — G. R. Watkins

Consulting Engineers

Municipal and Industrial Engineering, Water Supply and Purification, Sewerage and Sewage Treatment, Highways and Structures, Reports, Investigations and Rate Structures.

446 East High Street — Lexington, Kentucky
Branch Office
4736 Preston Highway — Louisville, Kentucky

WEINBERG & CUNNINGHAM

Engineering Consultants

Water Supply, Treatment & Distribution — Foundations
Sewage Treatment & Disposal — Highway & Traffic
Industrial Waste Treatment — Industrial & Municipal Buildings

Investigations, Reports, Appraisals, Rates, General Public Works Engineering

134 EAST THORNTON STREET, AKRON 11, OHIO

ROY F. WESTON, INC.

ENGINEERS—BIOLOGISTS—CHEMISTS

Industrial Wastes—Stream Pollution
Air Pollution—Water—Sewage
Surveys—Research—Development—Process Engineering—Plans and Specifications
Operation Supervision—Analyses
Evaluations and Reports

NEWTOWN SQUARE, PA.

WALTER H. WHEELER EM., M. A. S. C. E.

Designing and Consulting Engineer

Buildings Bridges, Mfg. Plants, Etc.
Inventor "Smooth Ceilings" Flat Slab Construction

802 Met. Life Bldg. — Minneapolis, Minn.
Tel. Federal 3-1019

FOR RATES FOR THIS SPACE

Write

PUBLIC WORKS MAGAZINE

200 So. Broad St., Ridgewood, N.J.

WHITMAN, REQUARDT and Associates

Civil—Sanitary—Structural
Mechanical—Electrical
Reports, Plans, Supervision, Appraisals

1304 St. Paul St., Baltimore 2, Md.

CLYDE E WILLIAMS & ASSOCIATES, INC.

Aerial Mapping
Civil & Sanitary Engineering

312 W. Colfax Ave., South Bend 1, Ind.
720 E. 38th St., Indianapolis 5, Ind.

WILSEY & HAM

Engineers & Planners

Water and Sewage Works
Flood Control and Drainage
Airports, Traffic Studies and Bridges
City and Regional Planning

111 Rollins Road, Millbrae, Calif.
800 W. Colorado Blvd., Los Angeles 41, Calif.

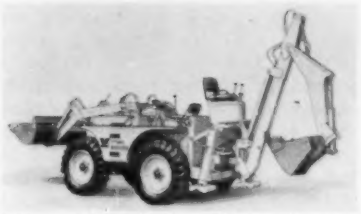
WILSON & COMPANY

Engineers

Water, Sewerage, Streets, Highways, Dams, Bridges, Electrical, Airfields, Drainage, Treatment Plants, Industrial Installations.
Chemical Testing Lab — Aerial Mapping
Electronic Computer Services

631 E. CRAWFORD — SALINA, KANSAS

PUBLIC WORKS
EQUIPMENT NEWS



Ottawa Marauder has plenty of power

Self-Propelled Backhoe and Loader

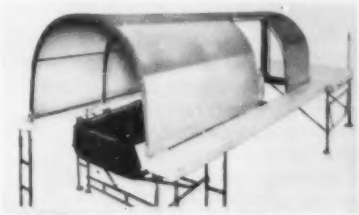
A new concept in a unit-designed self-propelled backhoe and loader is announced by Ottawa Steel Division. This new unit, called the Marauder, is not a tractor with attachments, but an integral digging and loading unit. The 4-wheel drive prime-mover has torque converter transmission capable of speeds from 0 to 25 mph, and shuttle clutch for change of direction without shifting. The backhoe is an integral part of the unit, and incorporates the Ottawa welded design, turret-type seat that pivots with the boom, rugged A-frame which supports outriggers, boom structure and swing mechanism, reverse-mounted cylinders for protection of the highly polished rams, simple two-lever controls for easy operation, and a wide range of bucket types and sizes, including exclusive Ottawa automatic ejector buckets. It digs 12½ ft. deep in any position of its 190° swing, making it possible to operate in hard-to-reach places. The loader bucket has 18° rollback for maximum pryout and load retention. Lift capacity is 4500 lbs., with 5000 lb. breakout. For complete information write Ottawa Steel Division, Young Spring & Wire Corp., Ottawa, Kans., or circle **No. 10-1** on the reply card.

Leveling Implement for Highway Building

A new road leveling implement, the C-126 DI road planer, is now available to contractors and state and municipal highway departments. The spring equalization action permits a constant cutting and filling which eliminates gouging and excess dumping and minimizes gravel segregation. Although the planer is only 25 ft. in length, for maneuverability and close turning it delivers a long leveling accuracy comparable to machines twice its length. The planer's 2½-cu. yd. capacity bucket is suspended at four points and may be controlled either manually or hydraulically. Other features include a 10-ft. reversible cutting blade, crank type stops, depth gauge, elevated tongue structure and dolly carriage. Further information from Speedline Implement Mfg. Co., Las Cruces, N. Mex., or circle **No. 10-2** on the reply card.

Highway planer's 2½ cubic yard bucket may be controlled manually or hydraulically

Boat Canopies of Nylon



Available in three brilliant colors, gold, green and red, the new Standard Steel nylon canopies are made of special close-woven Nylon. They are easy to install on specially designed tubular steel reinforced semi-circular ribs or frames, which are finished in rust-resisting, durable marine enamel. These semi-circular frame units, available in widths from 6 to 10 ft., can be easily bolted into position on the marina or pier, and are braced with cross-rods secured by simple collars and set screws. Special cleats at the base of each frame provide easy means for tying the Nylon cords sewed into the canopy. Entire erection can be completed in half an hour or less, with ordinary tools. Further details from Standard Steel Products Mfg. Co., 2836 South 16th St., Milwaukee 15, Wis., or circle **No. 10-3** on the reply card.

New Method Short Cuts Highway Sign Repainting

A new method to simplify and speed the repainting of aluminum street and highway signs has been announced by the Magnus Chemical Co. The new method calls for degreasing signs in Toluol or Xylol and wiping; then a shop rack is filled with as many signs as it will hold and all are sprayed at one time with a unique primer. This Magnus P-302 primer offers unusual adhesion properties to both the aluminum and old paint sub-surface and to new paint or Scotch-Lite applications which may be made over it. More information from Magnus Chemical Co., Dept. M-7, South Ave., Garwood, N. J., or circle **No. 10-4** on the reply card.

Refuse collection box weighs six lbs.

All-Weather Plastic Receptacle for Refuse Collection

The Back-Door-Box available from County Chemical is an all-weather receptacle for use in back door refuse removal service. It is made of plastic Tuflite and weighs 6 lbs. It has a 52 gal. capacity, is completely waterproof and will not crack in the cold. For complete data write County Chemical Co., 2475 North Jerusalem Rd., East Meadow, L. I., N. Y., or circle **No. 10-5** on the reply card.

New Drive Head for "Rota-Rake" Liquid Clarifiers

A horizontal spur-gear drive for heavy-duty applications of the Rota-Rake® clarifier and thickener has been developed by Graver Water Conditioning. This is a horizontal flow water and liquid treatment unit for gravity sedimentation and sludge thickening. The drive head is a strongly constructed, heavy-duty unit with a completely enclosed, integral gearing arrangement. The gears, operating in an oil bath, are of Mechanit cast iron as is the housing. Anti-friction ball and roller tapered bearings are used throughout and the pinions are of forged steel. Introduction of the new drive is indicative of the improvements and expansion which have been made. The line now consists of four unit types: (1) Type HC, heavy-duty center-post design for units over 50 ft. dia. and units over 30 ft. dia. when torque-loading is more than 200,000 ft.-lbs.; (2) Type HCS, center-post unit with surface skimmer attached to rake arm; (3) Type MB, medium size bridge-supported design for units under 50 ft. dia.; and Type MBS, same as MB but with skimmer. A fifth design comprises the thickener unit which has vertical pickets attached to the sludge scraper arms. For further information write: R. S. Lewis, Manager, Sales Promotion, Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y., or circle **No. 10-6** on the reply card.

New Maintenance Type Bituminous Distributors

Aeroil has announced a new line of bituminous distributors in the 400, 600 and 800-gallon sizes. The design permits you to add features you need to the standard machine. These units are furnished as trailers or on skids for truck mounting; you can utilize circulating or non-circulating spray bars, and the hand spray is always on hand for patching. Complete details from Aeroil Products Co., Inc., South Hackensack, N. J., or circle **No. 10-7** on the reply card.

School Traffic Signal System

A new school traffic signal system, known as Type PA-30, is announced by Crouse-Hinds. It is designed for operation at mid-block crossings. During the morning and afternoon,

School signal for mid-block crossings

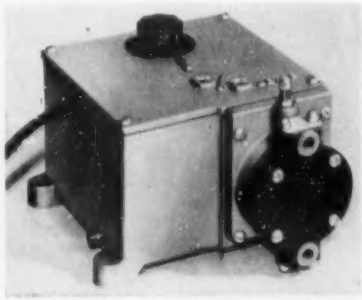
the signal operates automatically in response to push buttons. At other periods, the signal remains on normal highway "Go" indication. An electronic controller provides simple timing adjustments. Control knobs are easily turned to desired settings; no changing of gears or setting of dial keys is required. For complete information write Crouse-Hinds Co., Syracuse 1, N. Y., or circle **No. 10-8** on the reply card.

Inflatable Metal Tubing

Calumet & Hecla Div. of Wolverine Tube, has announced the availability of a light-wall seamless metal tubing that can be shipped in ribbon form and inflated at the point of use. The new material, to be known as "Strubing" (strip tubing), holds promise of major innovations in industries as diverse as construction, electric power distribution, communications and sewer and water lines. Lining by inflation techniques might be used to repair sewer and water mains that develop leaks. Rather than having to rip up a street or other ground surface to remove and replace sections of pipe, Strubing of some suitable material could be inserted and inflated to act as a protective "inner tube". The methods and equipment to be used for inflating Strubing have included hydraulic pressure, air pressure and mechanical means. Complete data from Wolverine Tube, Division of Calumet & Hecla, Inc., 17200 Southfield Road, Allen Park, Mich., or circle **No. 10-9** on the reply card.

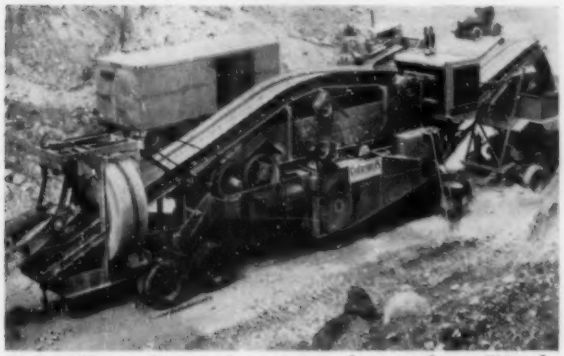
Chemical Metering Pump

CC Pump Division announces a new addition to their line of controlled capacity chemical metering pumps—a diaphragm pump designed for positive displacement metering of a wide range of corrosive and non-corrosive liquids. The pump will satisfy requirements of high accuracy, low flow metering with four flow ranges available up to the maximum of 2½ gph. The new pump operates against back pressures as high as 500 psi and wetted parts can be constructed of many materials such as plastic, stainless steel, nickel, etc. It is available in multi-head construction and for automatic proportioning from pneumatic or electric impulse signal. For more information write CC Pump Div., Clark-Cooper Co., 315 Market St., Palmyra, N. J., or circle **No. 10-10** on the reply card.



Pump handles high accuracy metering

Stone Crushing Plant



Cedarapids crushing and screening plant produces 500 tph

The new Cedarapids tandem crushing and screening plant incorporates larger components to give it a capacity of up to 500 tph of 1 to 4 product sizes. The unit does not sacrifice portability. When necessary, it can be fitted with a third air-suspension axle that will carry a load equal to the tandem axles and reduce axle load to under 18,000 lbs. With the feeder and hopper removed, weight on each of the three axles is under 16,000 lbs. The plant can be fed by a plant mounted feeder and hopper or by a ground level feeder and hopper driven by a swivel drive. Other design features include simplified drives, new belt wipers and an optional 48-in. x 10-ft. pre-screening attachment that allows the plant to produce 100 percent crushed material. For complete information write to Iowa Mfg. Co., Cedar Rapids, Ia., or circle **No. 10-12** on the reply card.

Clean Drainage Pipes

Auger removes all types of soil from culverts and pipes

Clogged culverts and drainage tubes can be opened speedily with the new hydraulic earth auger assembly, introduced by Topeka Hiway Mower. The horizontal auger and the drive box attach to the side of the Topeka Forty Mile mower. The entire assembly can be mounted or dismounted in 10 minutes and the auger uses the same hydraulic system as the mower. The culvert cleaning attachment consists of the drive box, a 20-ft. drive tube, 10-ft. tube extension plus two 10-ft. augers, one 6-in. and one 9-in. in diameter. In addition to the boring action, there is a certain amount of "whip" to the augers, making it possible to clean tubes larger in diameter than the augers. Further details from Topeka Hiway Mower, Inc., 623 East 7th St., Topeka, Kans., or by circling **No. 10-14** on the reply card.

Dewatering Well Point

A self-jetting dewatering well point that will penetrate semi-consolidated material such as clay and hardpan and a light-weight, quick-connecting swing joint system has been developed by Edward E. Johnson, Inc. The new Johnson green head dewatering well point is an all-welded continuous V-slot well screen with a special internal drop tube and sleeve valve that provides a more positive jetting action than heretofore possible with conventional self-jetting dewatering points. The screen body is fabricated from galvanized low-carbon steel for normal water, or from stainless steel for highly corrosive water. The unit withstands rough handling even under the most difficult dewatering conditions, and may be completely demounted for cleaning or for repairing of the component parts. For complete information write Edward E. Johnson, Inc., 315 North Pierce St., St. Paul 4, Minn., or circle **No. 10-11** on the reply card.

Allis-Chalmers Tractor Shovel

A new 1½ cu. yd. HD-6G tractor shovel is now available from Allis-Chalmers. It incorporates advanced design and engineering features which further increase the work capabilities, dependability, service simplicity and operator appeal of the unit. An Allis-Chalmers 4-cycle diesel engine rated at 72 net hp powers the unit. Four forward speeds from 1.5 to 5.5 mph and two reverse speeds of 2.0 and 4.1 mph may be selected with the single lever shift located within easy reach of the operator. Dumping height is over 9 ft. and reach is ample to get bucket loads out to the center of high sided trucks or up and over the sides of excavations. The new curved bottom bucket tips back 40° at ground level, with 21,500-lb. of pry-out force at the cutting edge. Rear-mounted matched attachments include a rock bucket, rock fork, light materials bucket, crane hook and straight and angling type dozers. These are mounted quickly by four pins. Complete details from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc., or circle **No. 10-13** on the reply card.

Adding Machines

A new, complete line of standard heavy-duty adding machines has been introduced by Clary Corp. The line includes two full-keyboard and two 10-key models: Model 169 adds, subtracts and multiplies up to eight digits; Model 148, a heavy-duty 10-key model that has everything except a credit balance and adds, subtracts and multiplies up to eight digits; Model 269, a deluxe full-keyboard model which has a visual credit balance, dividing eye and extra capacity key, adds, subtracts, multiplies and divides (without using reciprocal) up to nine digits; and Model 248, a heavy-duty 10-key machine with a credit balance which adds, subtracts and multiplies up to nine digits. More details from Clary Corp., 408 Junipero, San Gabriel, Calif., or circle **No. 10-15** on the reply card.

Measuring Wheel Is Operated By One Man

Rolatape Model #415 is a precision instrument for all-round outdoor measuring jobs

Of particular interest to engineers and contractors, a new measuring wheel that can be operated by one man, registering measurements to ½-in. on one side of the disc wheel and tenths of a foot on the other is available from Rolatape. The sturdily constructed Rolatape Model #415 has a wide neoprene tire that provides positive traction under all conditions. Equipped with an automatic brake and a built-in stand, the unit handle folds compactly when not in use. Convenient zippered carrying case is available. Curves and contours are measured just as easily as straight or flat surfaces. It can be operated from a car window when driving at low speeds. More details from Rolatape, Inc., Santa Monica, Calif., or circle **No. 10-17** on the reply card.

Bronze Frost Bottom for American Water Meters

A new breakable bronze frost bottom for American water meters is now available from Buffalo Meter. It is made from a brittle type of bronze which breaks cleanly at the same pressure as cast iron. It permits the meter to be all-bronze with no dissimilar metals yet with the sure protection of a true frost bottom. Complete details from Buffalo Meter Co., Inc., 2920 Main St., Buffalo 14, N. Y., or circle **No. 10-16** on the reply card.

Frost bottom for American water meter

New Pipe Repair Method Introduced

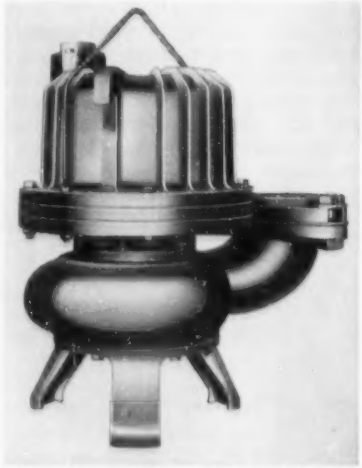
A new efficient method of repairing small leaks in any fluid or gas line is now available through the Industrial Sales Division of M. J. Crose Mfg. The Crose permanent pipe patch permits its users to stop leaks in pipe without shutting down the lines. The patch (individually contoured to fit each size of pipe and furnished complete with bonded Neoprene gasket) is placed directly over the leak, then held in place by the tool. When sufficient pressure is applied to the patch by the tool, the leak is immediately sealed off. Once the leak is sealed off, users can easily weld the patch on the pipe for a permanent repair or leave the tool in place for a temporary repair. Tools may be reused indefinitely. They are "hold-down" clamps of two types: Saddle type for ¾ through 6-in. pipe, and chain type for 7 through 36-in. pipe. More data from M. J. Crose Mfg. Co., Inc., Industrial Sales Div., P. O. Box 3368, Tulsa, Okla., or circle **No. 10-18.**

New Instrumentation for Filter Plant Operation

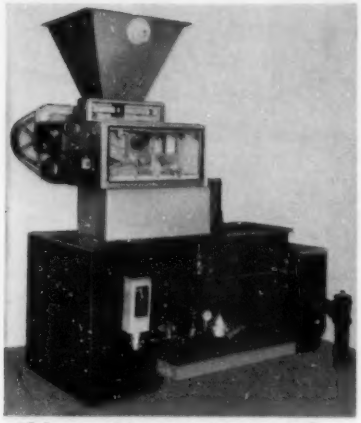
The Penn Instruments Div. of Burgess-Manning announces new instrumentation for filter plant operation. Their rate of flow controller, head loss gage and large-dial wash water indicator are new applications of standard Burgess-Manning instruments and venturis. A few of the unique features include dial setting of rate of flow at the control panel as well as manual or automatic selection, stainless steel venturis, elimination of hydraulic piping to the control station. It is adapted for modernizing existing installations as well as for new construction. For more details write Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa., or circle **No. 10-19** on the reply card.

New Immersipump Non-Clog Sewage and Sump Pump

A new line of submersible non-clog sewage and sump pumps are now available from Chicago Pump. Pumps feature low original and maintenance cost, ease of installation and servicing and the pump and motor operate completely submerged. The stainless steel bail enables easy installation and removal of the unit. The enclosed non-clog pump impeller passes solids up to 2½ in. The motor is specially designed for submersible operation, being totally-enclosed and oil-filled positively to assure water from entering the unit. Complete data from Chicago Pump Co., 622 W. Diversey Pkwy., Chicago, Ill., or circle **No. 10-20** on the reply card.



Immersipump is available with a new Sealtrode sealed electrode floatless pump controller for automatic control



Slaker used in water treatment plant

Omega Lime Slaker

The new Omega pug mill or paddle type lime slaker is an important addition to B-I-F Industries' line of slakers. The slaker requires less floor space, uses less water, requires shorter process time and can be operated over a wider range than the "retention type" lime slakers. The single shaft pug mill has a row of stationary blades that mesh with the rotating blades to insure proper mixing action and prevent rolling or "balling up" of the pasty mass of slaking lime. The agitator arms are spaced along the shaft in proper sequence to advance the lime slowly through the slaker regardless of the viscosity of the mixture. A short dilution section provides additional water through jets and violent agitation to thin the paste allowing the grit to precipitate. The slakers are all steel, welded construction. They are available in a range of sizes from 150 to 10,000 lb. per hr. For further information write to B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I., or circle **No. 10-21** on the reply card.

Roll-Forged Snow Plow Wearing Parts and Blades

A completely new line of roll-forged snow plow wearing parts and blades has been announced by Bucyrus Blades. This ForgeTemp line has been designed with uniformly high resistance to impact and abrasion wear throughout the cross-section of the wearing part or blade. Included in the line are shoes, nose pieces, wear plates, adapter brackets and plow and wing blades for every make and model of snow plow equipment. Complete details from Bucyrus Blades, Inc., Bucyrus, Ohio, or circle **No. 10-22** on the reply card.

1960 Chevrolet Truck Line

Impressive advances in ride, handling, durability and safety through an exclusive and revolutionary suspension system lead an imposing list of improvements in the 1960 Chevrolet truck line. Independent front wheel suspension with ball joints and torsion rod springs are on all but two of the series. Also an innovation is coil spring rear suspension on most ½ and ¾-ton models. Variable-rate, two-stage leaf spring rear suspensions are new on two-ton and up models. Tandems are equipped with the Eaton-Henrickson tandem suspension with short lightweight, variable-rate springs which are not required to absorb torsional strain. All sheet metal is integrated with the new chassis design for a much more rigid, lower, roomier, more accessible cab and sturdier front end assembly. Addition of several new models and the elimination of some previous ones results in a net expansion of the line to 165 models. There will be offered four basic engines, 235 and

Chevrolet Fleetside pickup is used on construction and maintenance

261 cu. in. sizes and the 283 and 348 cu. in. V8's. Twelve transmissions are available in the 1960 line. A two-speed Powerglide fully automatic transmission is optional equipment on ½- and ¾-ton conventional models. Hydramatic is retained as an option on forward-control models. Use of the improved Powermatic on larger units is continued and availability of five-speed manual transmissions is extended. Complete data from Chevrolet Motor Div., General Motors Corp., General Motors Bldg., Detroit 2, Mich., or circle **No. 10-23** on the reply card.

Buhler Process for Composting Municipal Garbage

Unsorted garbage from collection trucks is carried into a grinding mill by a conveyor, and all material—food, glass, cans, rags, etc.—ground and reduced to about ¼ of its original volume. This material is passed over a drum magnet where all iron particles are removed and is conveyed to a vibrating sieve where the heavy substances, as glass, are separated and passed to a roller mill which reduces them to sand. This fine material is again added to the rest of the ground material and the whole goes by conveyor to a storage bunker as raw compost. Raw compost can be sold immediately as hot-bed compost or conveyed to a composting yard for fermentation. The capacity of the plant averages 530 cu. ft. per hour, about 20 cu. yds. For large communities, several units, with decentralized grinding stations in the suburbs and a common composting yard are recommended. This reduces the cost of carting and the number of trucks. After treatment, the garbage is brought to a central composting yard. The ground garbage must be turned into compost, unless it is sold raw for hot-beds. For composting, the material is piled in heaps 5 to 6 ft. high with sloping tops; these piles must be aerated, preferably by turning. The fermenting period is 3 to 4 months and turning is by a bucket loader or shovel. When handling 3500 cu. ft. of garbage per day, the area of the compost yard should be about 3600 sq. yd. for a fermentation period of 100 days. More data from Buhler Bros., Inc., 130 Coolidge Ave., Englewood, N. J., or circle **No. 10-24** on the reply card.

Ice Control Spreader Features A Unique Conveyor System

A one-piece chainless, beltless, flightless 24-in. conveyor is the engineering highlight of the new Hi-Way Model Y ice control spreader. Developed especially for ice control work, the spreader overcomes common failures caused by frozen materials. The all steel conveyor system uses an oscillating motion to move material. The "up front" location of the spinner lets the operator observe the thoroughness of the spread. Also, it spreads material in front of rear wheels for extra traction. The 20-in. spinner is hydraulically operated and spreads from 2 to 4 lanes wide with ease. Complete data from Highway Equipment Co., Dept. H41-5, 616 "D" Ave., N. W., Cedar Rapids, Ia., or circle **No. 10-25** on the reply card.

Model TL-12 TractoLoader for Big Volume Light Construction and Maintenance Jobs

The TL-12 TractoLoader, made by Allis-Chalmers, is especially designed to speed and simplify excavating-loading work, including loading, backfilling and stripping. With 13,200 lbs. of breakout force, the TL-12 is suited to dig out asphalt, concrete and other hard-packed materials. The loader, which weighs 12,100 lbs. features power steering and the four-wheel drive provides stability and traction required for fast loading, even when operating under adverse ground conditions. Full reversing transmission lets the operator work all day without shifting gears. Top travel speed is 20 mph in the forward direction and top speed in reverse is 25 mph. More data from Allis-Chalmers Mfg. Co., Deerfield, Ill., or circle **No. 10-26** on the reply card.

BOD Incubator

Designed for installation under table or counter top, this new unit features modern functional design and automatic temperature control from 5° to 50°C. The control panel is recessed at the base of the cabinet to permit toe space at floor level. A plexiglass cover protects controls from accidental damage and discourages unauthorized adjustments. A stainless steel thermometer allows easy reading of the chamber temperature without opening the door. A built-in air circulation system insures maximum temperature uniformity and temperature control is within ±0.5°C. Complete data from Electric Hotpack Co., Inc., Dept. 687, Cottman & Melrose, Philadelphia 35, Penna., or circle **No. 10-27** on the reply card.

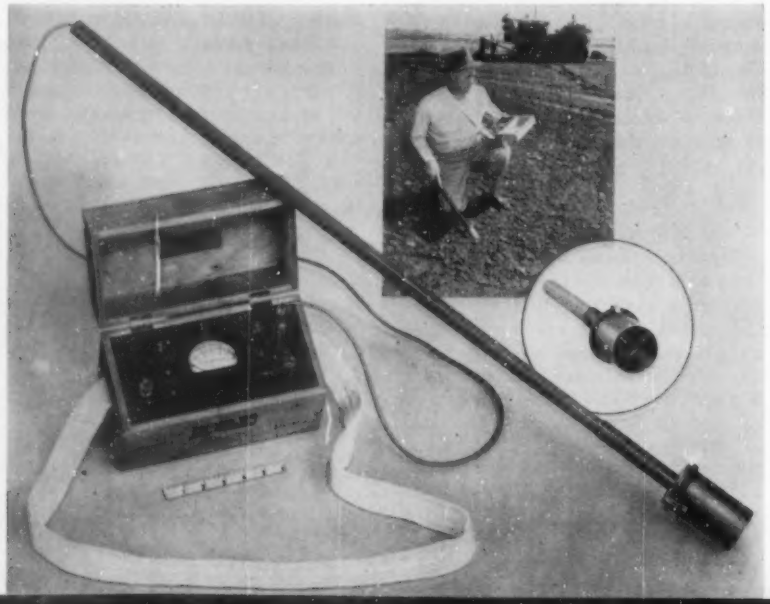
Air Ladder for Municipalities

The Air Ladder which can be readily mounted on any truck, 1½ tons or larger, has been introduced by Root Spring Scraper Co. It is hydraulically controlled, the hydraulic pump being powered by a 6 or 12-volt motor operating off the truck battery. No power take-off unit is involved. Platform working height is 22 ft. and safe load capacity is 500 lb. The swing arc is 170° and the operator can control the ladder from the platform. Further information from Root Spring Scraper Co., 527 West North St., Kalamazoo, Mich., or circle **No. 10-29** on the reply card.

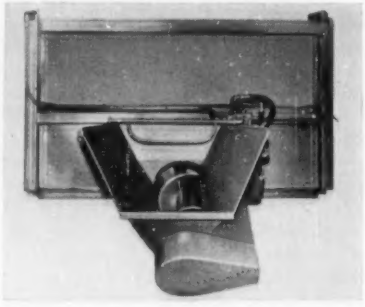
Ladders are hydraulically controlled

Electronic Portable Moisture Tester

Exact moisture content of sand, soil or any bulk material is measured instantly and automatically by a new portable moisture meter. This lightweight electronic instrument avoids costly delays and equipment downtime by taking the guesswork out of moisture content. Slung over the shoulder, it measures accurately the exact moisture content of surface or sub-surface sand, soil or any bulk material and registers on a dial the answer. More data from C&W Sales Co., 1490 Franks Lane, Menlo Park, Calif., or circle **No. 10-28** on the reply card.



Hydraulic Loading Attachment Converts Dump Trucks to Refuse Collection Trucks



Equipped with the Borg-Warner Sani-Matic refuse loader, a highway dump truck becomes an efficient low cost house-to-house refuse collection truck. The loader does not impair the truck's efficiency for normal dump truck work. The Sani-Matic refuse loader combines a worm-type loader unit and tail gate which replace the conventional tail gate of the truck. The tail gate and loader lift for dumping the load. The loader's hopper lip is waist high, making it easy to empty refuse receptacles into the hopper with a minimum of effort. Complete details are available from Borg-Warner Corp., Ingersoll Kalamazoo Div., Dept. PW, 1810 N. Pitcher St., Kalamazoo, Mich., or circle **No. 10-30** on the reply card.

CLASSIFIED ADVERTISING

INDUSTRIAL SUBDIVISION ENGINEER

For major Midwest railway company. Chicago office. Permanent. Good salary. Benefits. Experience in municipal engineering, zoning, utilities, roads and land planning for industry would be excellent background for man sought. Travel. Ability to work, make contacts, etc., without close supervision. Promotion opportunity excellent. Our employes know of this ad.

Write to:

Box 10-1

Care of Public Works Magazine

CIVIL ENGINEER WANTED

Registered Civil Engineer wanted by City of 7,000 population, located on the Minnesota-Canadian border. Salary is open. State qualifications, salary expected and full particulars.

Write to:

Vernon L. Peterson
City Clerk
International Falls, Minn.

WATER WORKS CHEMIST OR CHEMICAL ENGINEER

Graduate Chemist or Chemical Engineer wanted to supervise Production, preferably with water works experience and administrative experience in Water Filtration Plant and Hydro-Electric Plant. Salary range commensurate with experience and ability. Send resume, salary requirement and application to:

General Manager
Water Works & Hydro-Electric Plant
310 So. Wapello St.
Ottumwa, Iowa

SUPERINTENDENT OF SEWERAGE

Graduate Civil or Sanitary Engineer. Prefer previous experience in operation of activated sludge plant. Salary to $8556 per year, plus fringe.

Address inquiries to:

Personnel Department
Post Office Box 427
City of El Cajon, Calif.

SUPT. OF SEWAGE TREATMENT
Salary Range $590 to $810

Graduate in sanitary, civil, or chemical engineering with experience in sewage treatment. Supervise both primary and secondary plants. Apply CITY OF WICHITA, Room 407, City Building, Wichita, Kansas.

Administrative Assistant

Salary $4884 to $5808 per year. Graduate work desired. Apply to:

Mr. Robert W. Duncan
Village Manager
Shorewood, Wisconsin

NEWS OF ENGINEERS

NEWMAN E. ARGRAVES has returned to the private practice of engineering after serving more than four years as Connecticut State Highway Commissioner. Under the firm name of Argraves Engineers, with principal offices at 30 Park Row, Stamford, Conn., the firm will handle work in the highway, bridges, structural, water supply and sewerage fields.

FRANK FORCE, a member of the editorial staff of PUBLIC WORKS for the past four years, has been appointed Borough Manager and Engineer for Hellertown, Pa.

S. E. RIDGE, formerly Assistant Chief, Division of Development, Office of Operations, Bureau of Public Roads, Washington, has been promoted to the position of Special Programs Coordinator, Office of the Assistant to the Federal Highway Administrator. In his new position, Mr. Ridge will be responsible for directing Bureau activities in coordinating water resources projects and highway development, including navigational clearances in highway bridges; and for other duties.

BERNARD S. BUSH, highly regarded sanitary engineer of the Pennsylvania Department of Health, which he served for 31 years, died Aug. 4, 1959.

HENRY L. DABNEY, for a number of years Chief of the Water Supply Section, Texas Health Dept., has been promoted to Associate Director, Division of Sanitary Engineering, with the same organization.

WILLIAM C. GIBSON had to cut short a European tour sponsored by WHO to take up the position of Acting Dean, School of Public Health, University of Michigan, following the retirement of HENRY F. VAUGHAN.

HAROLD F. ELKIN of the Sun Oil Co. has been named to the National Task Committee on Industrial Waste as an alternate member representing the petroleum industry.

NEW ALL-AMERICAN PICNIC GRILL

It's *tops* in grills! Positive six-way draft control provides faster, easier fire kindling, saves fuel, guarantees tenderer, juicier charcoaled steaks, chops and barbecues. American's many plus-features assure perfect *lifetime* performance. Shipped fully assembled.

STATIONARY
Weight 180 lbs.
COMPLETE
$43.70

PORTABLE
Weight 205 lbs.
COMPLETE
$49.85

PATENTS PENDING

Order Your All-American Grill TODAY!

AMERICAN PLAYGROUND DEVICE CO.
ANDERSON, INDIANA

TWO PIECE

sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.

Adjustable
VALVE BOXES
THREE PIECE

valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Complete line of service and roadway boxes.

ALABAMA PIPE CO.

General Sales Offices ANNISTON, ALABAMA

We Invite Inquires to Our Nearest Sales Office

122 South Michigan Ave., Chicago 3, Illinois.
350 Fifth Ave., New York 1, N.Y.
950 Dirks Building, Kansas City, Missouri
18505 W. Eight Mile Rd., Detroit 41, Mich.
5335 Southern Ave., South Gate, Calif.

APCO

INDEX OF ADVERTISEMENTS

Adams Co., Inc., R. P. 42
Air Placement Equipment Company 20
Alabama Pipe Co. 231
Allis-Chalmers ..... 16, 17 & 143
Aluminum Company of America 63
American Concrete Corp. 217
American-Marietta Company 37
Concrete Products Division
American Playground Device Company 231
American Steel & Wire ..... 214 & 215
Division of United States Steel
ARPS Corporation 34
Aurora Pump Division 195
New York Air Brake Company
Austin-Western 163
Construction Equipment Division
Automatic Signal Division 75
Eastern Industries, Inc.
Ayer-McCord Clay Co., Inc. ..... 12 & 13

Badger Meter Mfg. Company ..... 68 & 69
Baldwin-Lima-Hamilton 163
Baughman Mfg. Co. 40
Bethlehem Steel Company 80
Blackburn-Smith Mfg. Co., Inc. 234
Blaw-Knox Company 50
Bowerston Shale Co. ..... 12 & 13
Bros Incorporated 51
Brown Company 14
Bucyrus-Erie Company 73

Calgon Company 162
Cannelton Sewer Pipe Co. ..... 12 & 13
Cast Iron Pipe Research Assoc. ..... 9, 10 & 11
Cataphote Corporation 160
Caterpillar Tractor Co. ..... 4 & 94
Caterpillar Tractor Company 62
Engine Division
Chain Belt Company 19
Chase Manhattan Bank 179
Chevrolet ..... 23, 24 & 25
Division of General Motors
Chicago Bridge & Iron Co. ..... Third Cover
Chicago Pump Co. ..... 30 & 31
Clark Company, H. W. 212
Clark-Wilcox Company 34
Netco Division
Classified Ads 231
Cleveland Trencher Company 201
Climax Engine Mfg. Co. 21
Division of Waukesha Motor Company
Cloroben Chemical Corp. 193
Clow & Sons, Inc., James B. ..... 148 & 149
Columbia-Geneva Steel Division ..... 214 & 215
Combustion Engineering 47
Cutler-Hammer Inc. 209

Darby Corp., The 156
Darling Valve & Mfg. Co. 151
Dempster Brothers ..... 60 & 61
Diamond Alkali Company 165
Dickey Clay Mfg. Co., W. S. ..... 12 & 13
Dorr-Oliver Inc. 183
Douglas Fir Plywood Association ..... 174 & 175
Dow Chemical Company 167
Dratt Manufacturing Company ..... 26 & 27

Earthworm Boring Machine, Inc. 66
Econolite Corporation 35
Eimco Corporation 74
Enterprise Engine & Machinery Company 206
Subsidiary of General Metals Corp.

Fabri-Valve Company of America 84
Fischer & Porter Company ..... Second Cover
Fisher Research Lab., Inc. 66
Fitchburg Engineering Corp. 41
Flexible Inc. 188
Flex-O-Lite Mfg. Company 87
Flink Company 170
Ford Motor Box Company, Inc. 146
Ford Motor Company ..... 138 & 139
Forneys Inc. 72
Foxboro Company 39
Frink Sno-plows, Inc. 88

Gar Wood Industries, Inc. 82
General Electric Company ..... 55 to 57
Gledhill Road Machinery Co. 54
Gorman-Rupp Company 44

Hamilton Kent Mfg. Co. 137
Hammarlund Mfg. Co. 145
Healy-Ruff Company 72
Hersey Mfg. Co. 147
Holan Corporation 53
Subsidiary of The Ohio Brass Co.
Hough Company, Frank G. 71
Hydepak Division 65
Hobbs Trailer Co.
Hydro E-Z Pack 48
Division of Hercules Gallon Products, Inc.

Infilco Inc. 155
International Harvester Company ..... 26 & 27
International Salt Company 171

Jeffrey Manufacturing Company 189
Johns-Manville ..... 153, 202 & 203
Johnson Gear & Mfg. Co., Ltd. 210
Josam Mfg. Company 86

Kaiser Aluminum & Chemical Sales Inc. 67
Keasbey & Mattison 187
Kerrigan Iron Works Company 70
Kohler Company 210
Komline-Sanderson Engineering Corp. 185
Koppers Company, Inc. ..... 190 & 191
Tar Products Division

Laclede Steel Company 211
Leopold Company, Inc., F. B. 152
Link-Belt Company 15

M & H Valve & Fittings Co. 194
Massey-Ferguson Industrial Division 33
McCabe-Powers Auto Body Company 164
Meadows, Inc., W. R. 218
Measure-Rite, Inc. 150
Subsidiary of Badger Meter Mfg. Co.
Minnesota Mining & Manufacturing Co. 79
Miro-Flex Company, Inc. 166
Monarch Road Machinery Company 168
Morse Boulger Inc. 141
Morton Salt Company 161
Mueller Co. ..... 8 & 58
Municipal Service Company 181

Natco Corp. ..... 12, 13 & 197
National Clay Pipe Mfrs., Inc. 83
National Power Rodding Corp. 168
Neenah Foundry Company 46
Newark Brush Company 45

O'Brien Manufacturing Corp. 184
Oliver Corporation 49
Orangeburg Mfg. Co., Inc. 52

Pacific Flush Tank Co. ..... 177 & 178
Pacific Mercury 204
Pacific Pumping Company 85
Palmer Filter Company 54
Permutit Division 199
Phelps Dodge Refining Corp. 142
Pipe Linings 138
Div. of American Pipe & Construction Co.
Pomona Terra-Cotta Co. ..... 12 & 13
Portland Cement Association 76
Process Engineers, Inc. 78
Public Works 182

Recordak Corporation 81
Subsidiary of Eastman Kodak Co.
Ridge Tool Company 18
Roberts Filter Mfg. Co. 204
Rynal Corporation 172

Seamen-Andwall Company 173
A Subsidiary of American-Marietta Co.
Service Recorder Company 22
Skinner Company, M. B. 39
Simplex 77
Div. of Pfaudler Permutit Inc.
Sika Chemical Corporation 3
Stamco Mfgs. & Sales Inc. 38
Standard Dry Wall Products, Inc. 64
Steel Plate Fabricators Assoc. 93
Sumo Pumps Inc. 196
Synchro-Start Products Inc. 38

Tarrant Manufacturing Company 36
Tennant Company, G. H. 188
Tennessee Coal & Iron Division ..... 214 & 215
Tennessee Corp. 43
Texas Vitrified Pipe Co. ..... 12 & 13
Thompson Pipe & Steel Company 154
Trickling Filter Floor Institute ..... 12 & 13

Union Metal Mfg. Company 139
U. S. Pipe & Foundry Co. ..... 28 & 29
United States Steel Export Co. ..... 214 & 215

Vermeer Manufacturing Company 140
Visi-Meter, Inc. 182

Wagner Electric Corporation 198
Walker Process Equipment Inc. 6
Wallace & Tiernan Co., Inc. ..... Back Cover
Washington Aluminum Company, Inc. 134
Westinghouse Electric Corp. ..... 89 to 92
Wilkinson Products Company 198
Wood Company, R. D. 200

Zimmer & Francescon 6

CONSULTING ENGINEERS APPEAR ON PAGES 219 to 224

PUBLIC WORKS JOURNAL CORP.

200 So. Broad St., Ridgewood, New Jersey

OFFICERS

W. A. Hardenbergh, *President*
Lewis C. Morris,
Vice President and Treasurer
Edward B. Rodie, *Secretary*

BUSINESS DEPARTMENT

Lewis C. Morris, *General Manager*
I. James Barger, *Business Manager*
Arthur K. Akers,
Director, Advertising & Research

ADVERTISING OFFICES

Ridgewood, N. J., 200 So. Broad St.
W. S. Morris

Cleveland 10, Ohio, Villa Beach 2,
15445 Lake Shore Blvd.
Burton M. Yost, *District Mgr.*

Los Angeles 36, Calif.
5478 Wilshire Blvd.
Hugh Hollyday, % *Smith & Hollyday*
David W. Zander

Chicago 1, Ill., 333 N. Michigan Ave.
Robert J. Shea, *Mid-West Sales Mgr.*

Philadelphia 10,
1434-36 Land Title Bldg.
Rod Ellis

San Francisco 4, Calif., Russ Building
Bill Smith, % *Smith & Hollyday*

Kansas City, Mo.
4916 West 64th St., Mission, Kansas
C. H. Stockwell

WORTH SEEING

Meeting An Earthquake's Challenge

WITH ONE GIANT SHAKE in southwestern Montana on the night of August 17 an earthquake dumped almost 35 million yards of earth into a mammoth dam, tilted a reservoir, wiped out four sections of Highway No. 1, and probably buried at least 20 persons.

Most of the damage occurred along the Madison River in Gallatin National Forest. The quake knocked the top off an 8,000-foot mountain, blocking the river seven miles downstream from Hebgen Dam with earth and rock piled about 200 feet high, a mile long and a half-mile across the canyon. Most of the casualties were caused by this slide. A fissure some 20 miles long caused the land to sink from 6 to 15 feet along the north side of the Madison River. Four sections of the Highway sunk or slid into Hebgen Lake, bottling up 200 campers and tourists between the big slide and the broken road. Steep hillsides (1½ to 1 grade) lined the sections where the slides occurred.

Here is how men and machines met the ensuing challenge. Naranche & Konda Construction Co., of Butte, was grading 9.7 miles of US 191 in Gallatin Canyon, 35 miles away. At 5 A. M. August 18 the call came to them to help punch an emergency road around the slide along the lake. Two Caterpillar DW20 and one DW21 Tractor-Scrapers and two Cat No. 12 Motor Graders sped to the scene while three D8 Tractors were being trucked in. By mid-morning the D8s were pioneering an emergency road high up on the hillsides to avoid more sliding, with the ground still quivering with after-shocks.

In two days with these machines the contractors built two miles of emergency roads, restored sunken bridge approaches, repaired eight miles of road, and released 50 carloads of survivors.

Many questions, of course, remain. Are more people still buried? And what to do with the huge slide and the knocked out sections of Highway 1? It will take more machines to get the answers.

Photos courtesy Caterpillar Tractor Company

● **WHEN THE EARTHQUAKE** struck, this hillside slid into Hebgen Lake, carrying several hundred feet of Highway 1 with it and destroying other sections of road.

● **IN TWO DAYS** these machines built two miles of emergency bypass road, graded and restored approaches to three bridges and repaired eight miles of the highway.

● **CAR CARRYING** an emergency unit of divers to search for possible sunken vehicles travels bypass road that was hastily constructed to span the slid-out section.

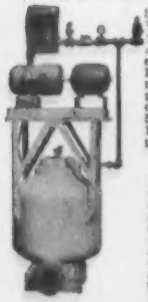
THERE ARE TIMES WHEN THE BEST NEED NOT COST THE MOST

You get what you pay for, every time . . . and it PAYS to invest in the experienced engineering, expert workmanship and dependable operation of

BLACKBURN-SMITH

Pneumatic

SEWAGE EJECTORS



Satisfied users of Blackburn-Smith Ejectors everywhere are convinced they've made the best investment in "B-S" efficient, economical, uninterrupted sewage lift service. No pump troubles; no clogging or cleaning; no complex piping; lowest maintenance cost. Single, duplex units. 30 to 500 g.p.m. Discharge heads to 150 ft. The dependably engineered product of 60 years of experience.

SEND FOR LATEST BOOKLET

Booklet S-55 gives piping diagrams for electrode and float switch controls; dimensions and layouts for single and duplex systems; all needed installation and operating data. Write for your copy today.

S 55

BLACKBURN-SMITH MFG. CO., INC.
59 Garden St., Hoboken, N. J.
OLdfield 9-4425
N. Y. Tel., BArclay 7-0600

by Arthur K. Akers

★ **D. K. Heiple** named manager of newly-formed Sales Development Department at LeTourneau-Westinghouse Co., Peoria, Ill. **J. E. Sheets** becomes Eastern Sales Manager.

★ Over 4,000 inquiries had been received during the first two months of the Cast Iron Pipe Research Association's nationwide program to enlist public support for vitally needed water utilities expansion.

★ **W. R. "Dick" Hager** joins Komline-Sanderson Engineering Corporation Sanitary Engineering Division, at Peapack, N. J.

★ **Gordon W. Johnson** becomes director of research, James B. Clow & Sons Inc., manufacturers of cast iron pipe and other water works products.

Mr. Johnson

Mr. Boggs

★ **James S. Boggs** heads the new Central District Office of The Union Metal Mfg. Co. in Prairie Village (Kansas City) 15, Kans.

★ On Jan. 1, 1960, two of the oldest and best-known Companies in the meter business, it is announced, will merge as the Hersey-Sparling Meter Company. Hersey Mfg. Company's president, **Winthrop P. Hersey,** will head the new firm, with headquarters at the new Hersey plant in Dedham, Mass. **Ray C. Sparling,** currently president of the Sparling Meter Co., will be vice president.

★ **Harry N. Dietz** is appointed a vice president of Orangeburg Mfg. Co., a division of The Flintkote Co. He continues in charge of conduit sales in the New York offices.

★ **Paul H. Brown** is now eastern regional manager, The Elgin Corporation, national representatives for sweepers, refuse bodies, etc. **Vern C. Deming** is named East-Central regional manager.

★ Denver Equipment Co. (Colo.) names **H. J. Gisler** manager of Eastern Sales.

★ Globe Linings Inc., Long Beach, Calif., becomes an eleven-states distributor of B. F. Goodrich plastic linings for reservoirs. Globe will also serve as engineers and contractors for Koroseal Linings.

★ Newark Brush Co. (N. J.) reports being forced by its street sweeper brush sales to add 50% to manufacturing capacity, at Kenilworth, N. J.

★ Neenah Foundry Co., Neenah, Wis. is doubling its capacity with a new plant; work began July 22.

★ Shawnee Mfg. Co., Topeka, Kans. passes to the ownership of Koehring Company, as part of the Parsons Division at Newton, Iowa.

★ **John M. Hess,** an architectural engineer, becomes technical director for the Douglas Fir Plywood Association, known in this field as producers of highway sign material.

★ **Vernon S. Tate** will be West Coast reflective products sales manager, at San Francisco, for Minnesota Mining & Manufacturing Co.

★ The words PRICELESS WATER painted on elevated tanks is the latest startlingly good idea for emphasizing value of adequate water supplies. Johns-Manville, 22 E. 40th, New York 16, offers a folder giving full details.

★ **Thomas W. (Tom) McCreery** retires as southern sales manager, U. S. Pipe and Foundry Co., Birmingham, after 47 years service. **Bartlett Bretz** succeeds him.

★ It may not be your fault—only your funeral!

—Carolina Highways

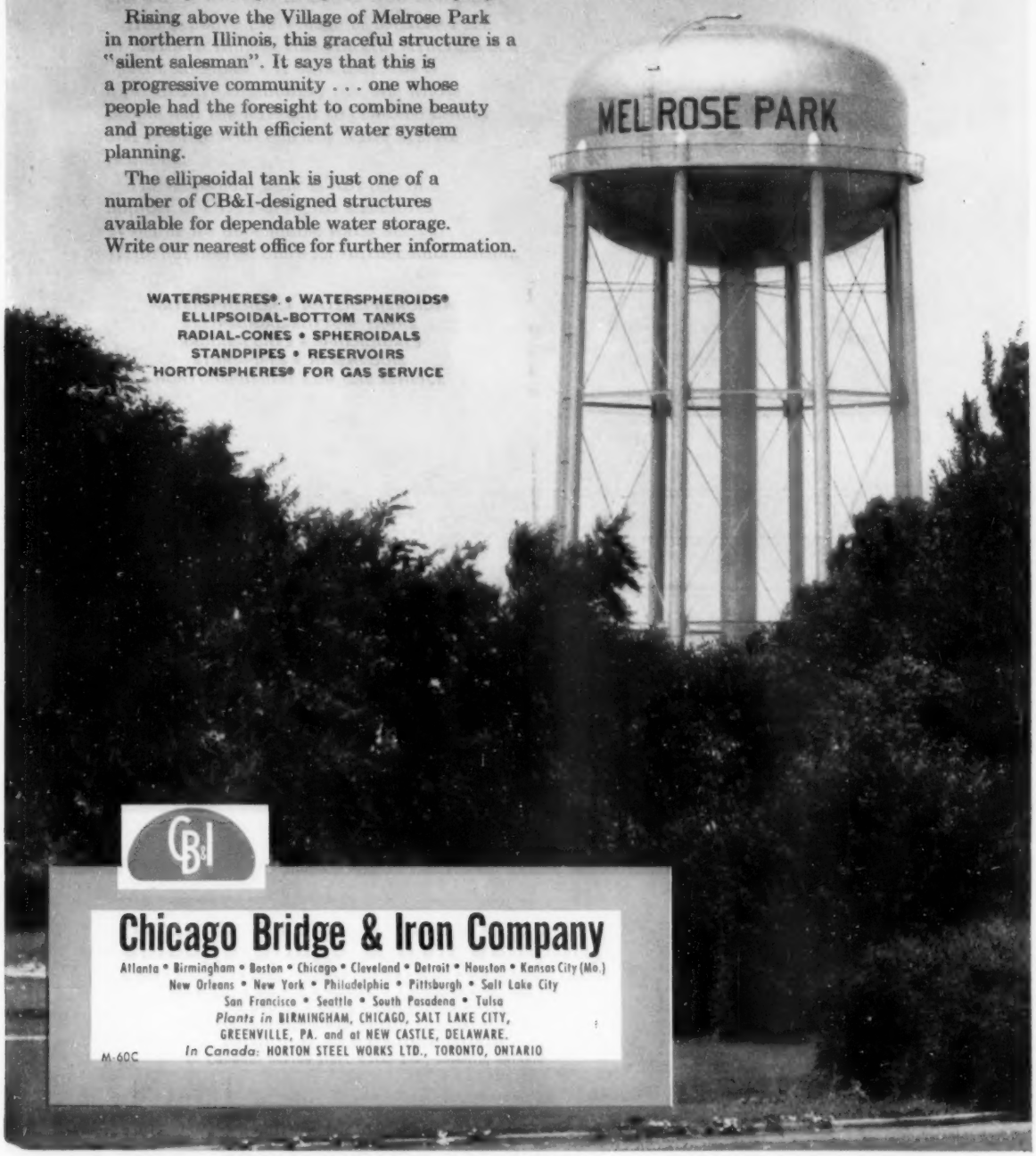
Water-Wise Communities Choose CB&I Elevated Storage Tanks

This is a 500,000-gallon Horton ellipsoidal-bottom tank designed, fabricated and erected by Chicago Bridge & Iron Company.

Rising above the Village of Melrose Park in northern Illinois, this graceful structure is a "silent salesman". It says that this is a progressive community . . . one whose people had the foresight to combine beauty and prestige with efficient water system planning.

The ellipsoidal tank is just one of a number of CB&I-designed structures available for dependable water storage. Write our nearest office for further information.

WATERSPHERES® • WATERSPHEROIDS®
ELLIPSOIDAL-BOTTOM TANKS
RADIAL-CONES • SPHEROIDALS
STANDPIPES • RESERVOIRS
HORTONSPHERES® FOR GAS SERVICE

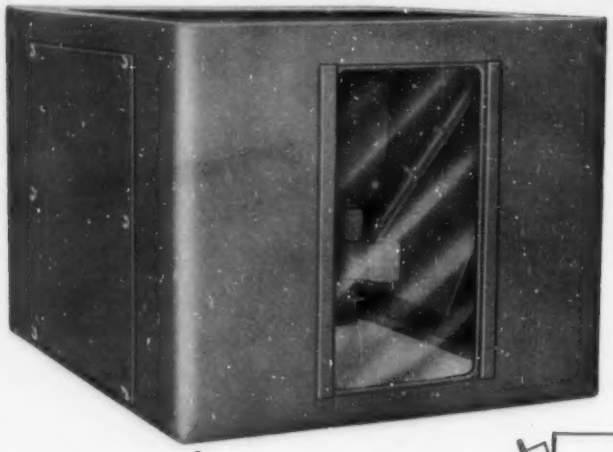


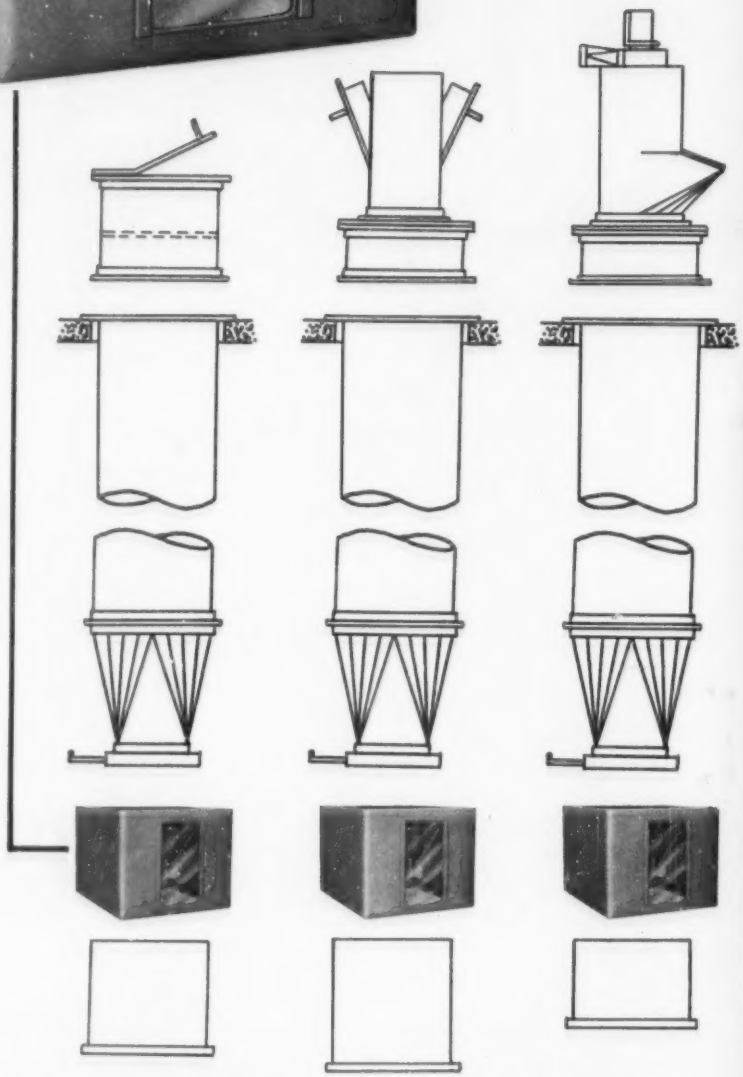
Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY,
GREENVILLE, PA. and at NEW CASTLE, DELAWARE.
In Canada: HORTON STEEL WORKS LTD., TORONTO, ONTARIO

M-60C

NOW "*Add-To-Design*" PAVES THE WAY TO SIMPLER FEEDER INSTALLATIONS





The W&T Series A-728 Dry Chemical Feeder forms a base for a complete feeder installation. Standard components are available —designed for use with the Feeder. For instance, the A-728 permits

. . . use of hoppers in standard lengths and sizes—ending your hoppering problems.

. . . choice of solution tanks—corrosion resistant and tight for the chemicals you use.

. . . direct feeder mounting of standard dust collectors, bag loaders, screens—eliminating extra structural supports.

. . . use of overhead supports—to eliminate your floor stress problems.

This means you use standard components to build your own custom installation without special design . . . saves you time and money.

■ ■ ■ ■

Write us for information to help you build your own feeder installation—easily and simply. Address Dept. MV-2.78.

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY